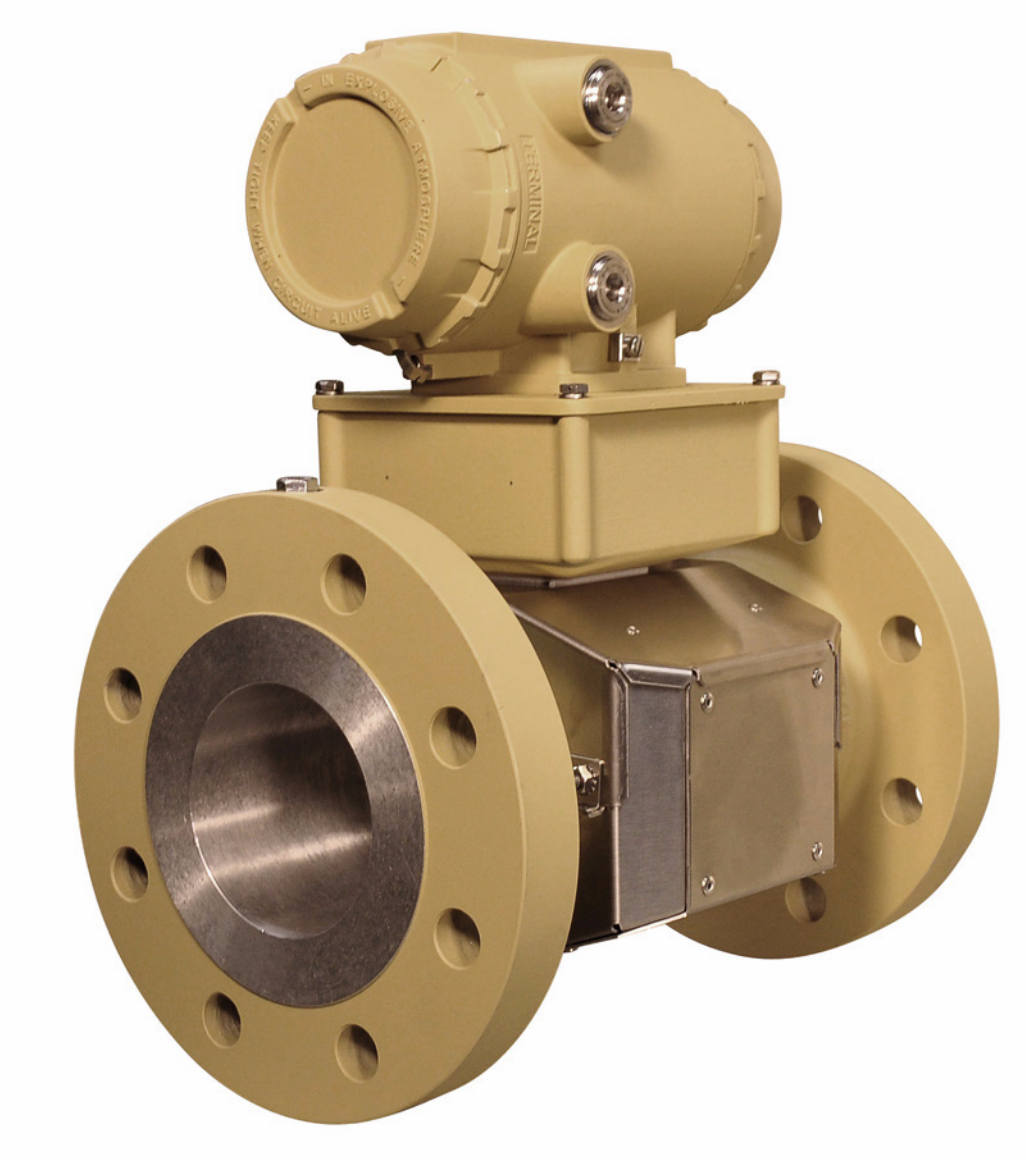
Maintenance and Troubleshooting Manual
Part Number 3-9000-767Revision A
June 2011

Daniel™ 3812 Liquid Ultrasonic Flow Meter



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Daniel™ Measurement and Control, Inc.

Daniel 3812 Liquid Ultrasonic Flow Meter
Maintenance and Troubleshooting Manual

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Section 1: Routine maintenance

1.1 Meter maintenance

This section includes discussion of the maintenance of Daniel 3812 Liquid Ultrasonic Flow Meters.

For reference, you may download the Daniel MeterLink Quick Start Manual from:

http://www2.emersonprocess.com/en-US/brands/daniel/Flow/ultrasonics/Pages/Ultrasonic.aspx

Daniel MeterLink may be downloaded at no charge from:

http://www2.emersonprocess.com/en-US/brands/daniel/Flow/ultrasonics/Pages/MeterLink.aspx

⚠CAUTION

SURFACE TEMPERATURE HAZARD

Meter body and piping may be extremely hot or cold

Wear personal protective equipment when coming in contact with the meter. Failure to do so may result in injury.

⚠CAUTION

TRANSPORTATION HAZARD

When moving the meter, do not insert the forks of a forklift into the bore.

Inserting the forks may cause the meter to become unstable, resulting in injury or damage to the bore and sealing face.

⚠WARNING

CRUSHING HAZARD

During meter installation or removal, always place the unit on a stable platform or surface that supports its assembled weight.

Failure to do so could allow the meter to roll, resulting in serious injury or equipment damage.

⚠ CAUTION

TRIPPING HAZARD

Clear all obstacles or obstructions from the work area when transporting, installing or removing the meter.

Failure to clear the work area may cause injury to personnel.

⚠ CAUTION

ESCAPING FLUIDS HAZARD

The purchaser of the meter is responsible for the selection of Daniel components/seals and materials compatible with the chemical properties of the measurement fluid.

Failure to select suitable meter components/seals may cause escaping fluids, resulting in injury or equipment damage.

1.2 Field hydrostatic pressure testing procedures

The Daniel 3812 Liquid Ultrasonic Flow Meter can be hydro-tested without any special preparations. The transducers are not exposed to the process pressure and can remain installed in the meter.

The liquid ultrasonic meter pressure containing parts include but are not limited to the transducer housings. These pressure containing parts are pressure tested attached to the meter body as a completed ultrasonic meter assembly. The hydrostatic test is verification of the pressure containing capability of the liquid ultrasonic meter, pressure containing parts and the seals that seal them.

⚠ CAUTION

LEAKAGE OR PRESSURE CONTAINING PARTS FAILURE

Use precautions to eliminate hazards to personnel in the event of leakage or failure of the liquid ultrasonic meter pressure containing parts or failure of the test equipment and to prevent over-pressurization during the test procedure.

Failure to do so may result in injury to personnel or cause damage to the equipment.

1.3 Routine maintenance

Routine maintenance operations requires adherence to all applicable regulations and laws and safety training for personnel to perform the maintenance operations. Review your organization's best practices procedures before performing routine maintenance.

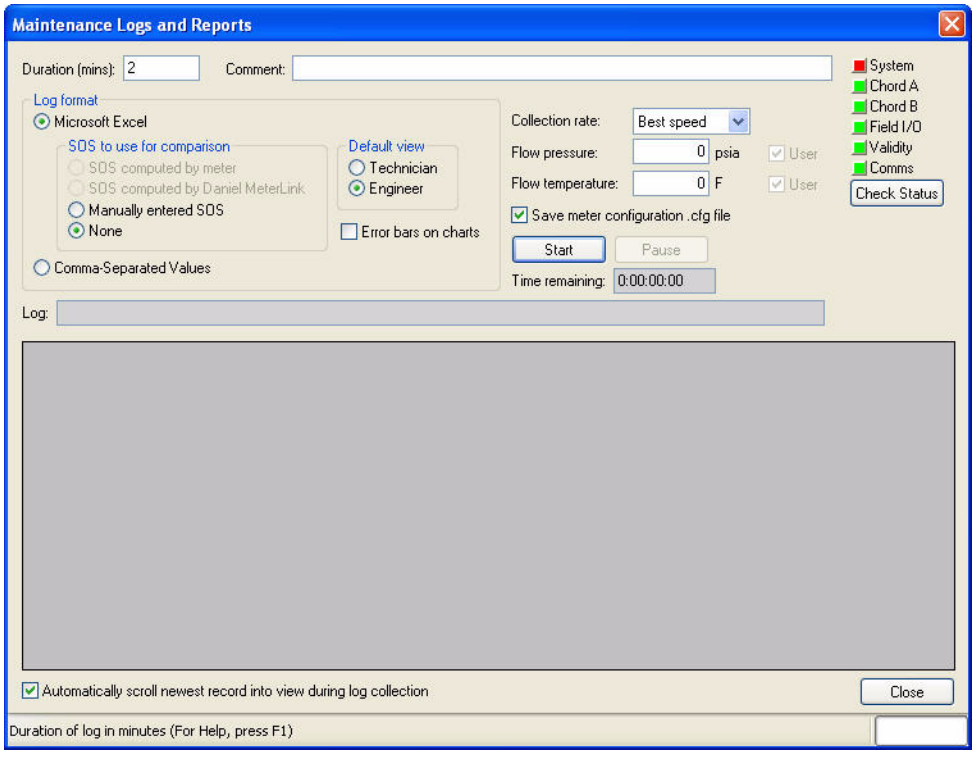
1.3.1 Maintenance logs and reports

To monitor the performance health of the meter, and ensure it is operating within acceptable specifications, routine diagnostics should be performed. Collecting a maintenance log gives you a snapshot of the current health of the meter and you can compare the inspection reports from previously saved logs. Use the Logs/Reports menu and click Maintenance Logs and Reports. Daniel MeterLink displays the Maintenance Logs and Reports dialog. Choose the time duration, log format and collection rate for the output file and click the Start button. You can open the file immediately after it is generated or view it at a later time. It is recommended that a Maintenance log be collected after an upset in the system.

In establishing a baseline to be used for the trending of the meter diagnostics, it is very helpful if a set of log files are collected immediately after the meter has been installed in the field. Preferably, collect the log files at several velocities within the operating range of the meter. This helps establish that the flow profile is relatively constant throughout the meters operating range (except velocities below 3 ft/sec where the profile may vary).

Maintenance log collection

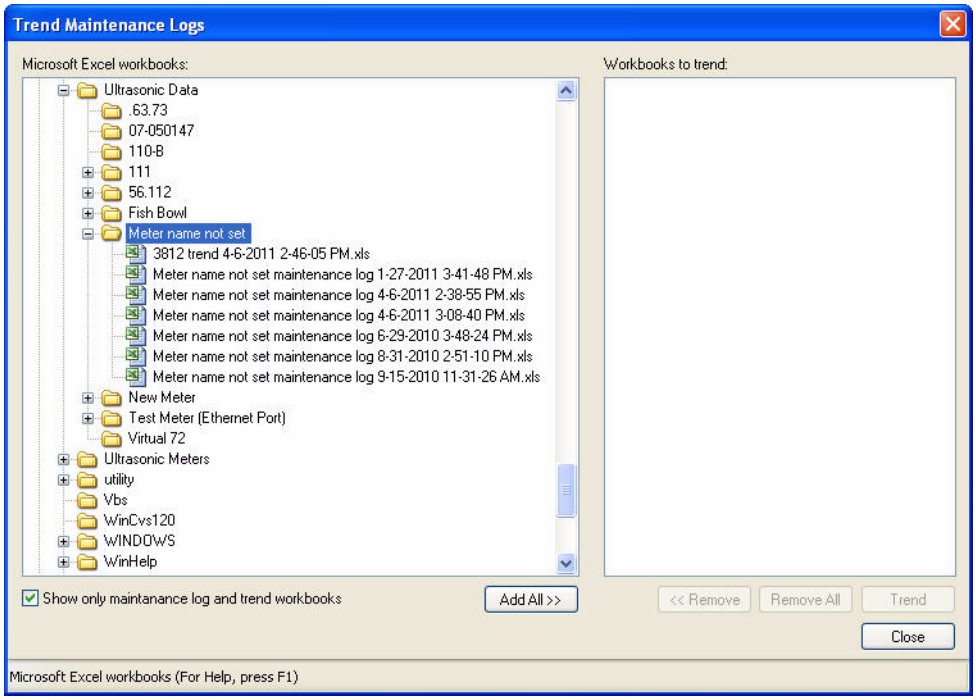
Figure 1-2 Maintenance log collection parameters



Trend maintenance log collection

Merging the results of two or more Maintenance logs into a single file, allows you to build a historical database of the meter's performance. Trending the logs indicates changes from the original installation of the meter, or over time. Looking at a single inspection report, that is either collected monthly or quarterly, can give you an indication of the meter's health.

Figure 1-3 Trend log collection



This is important since many diagnostics change slowly over time. Trending the maintenance logs helps identify these changes and makes problems much more obvious than merely viewing a single inspection report. The Trending feature is integral to Daniel MeterLink which allows all important parameters to be trended. Daniel MeterLink supports trending files in a Microsoft® Excel® workbook from multiple 3812 meter maintenance logs. Some parameters like gain, signal level, and noise level level may show a shift over time which can be useful in detecting changes in the meter and the installation.

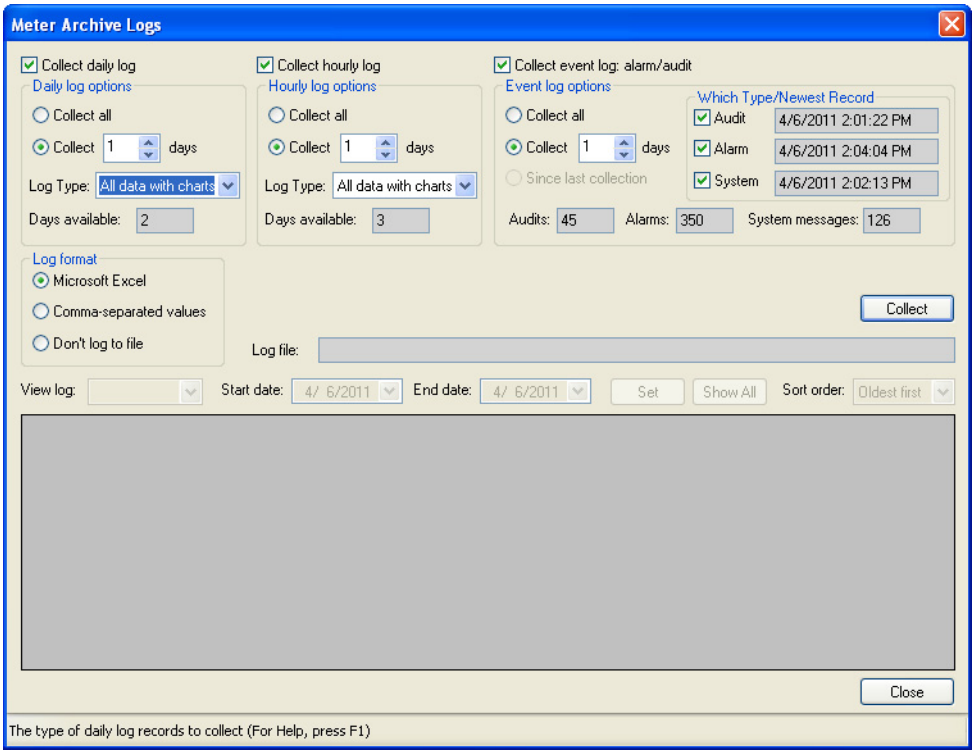
Maintenance logs or Trend files to be trended must all have matching column headings. This means the logs must be in the same units (i.e. U.S. Customary or Metric), must have the same pressure type (i.e. gage or absolute), and must have the same time base (1/second, 1/minute, 1/hour, 1/day). If not, an error message will be displayed stating the column headings do not match and the file will not be added to the Workbook to trend list.

Archive log collection

Archive logs may be collected and the options include:

- Daily log - generated every 24 hours on the Contract Hour.
- Hourly log - generated every hour at the top of the hour.
- Event log - collects the alarm and event log records.

Figure 1-4 Archive log collection parameters



The logs may be collected in a single file or you can choose to collect one type of log. Each of the Meter Archive logs include the Meter Configuration file.

1.3.2 Pipeline cleaning maintenance

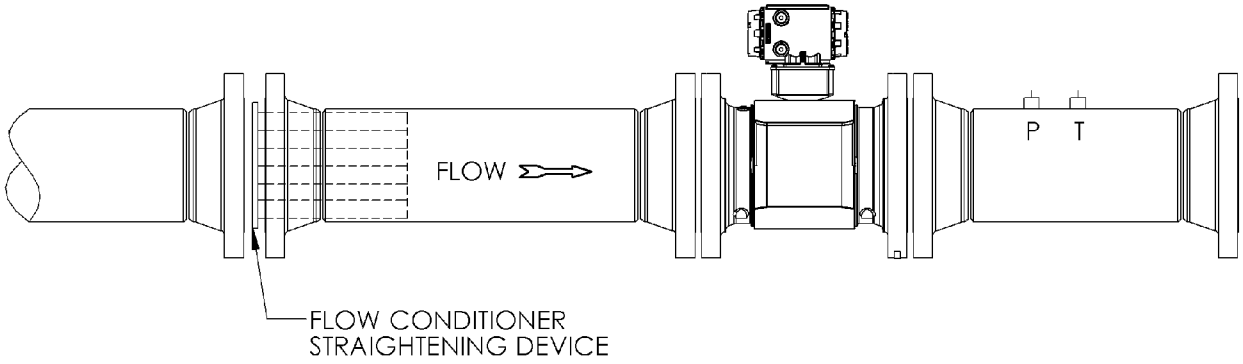
⚠WARNING

BURST HAZARD

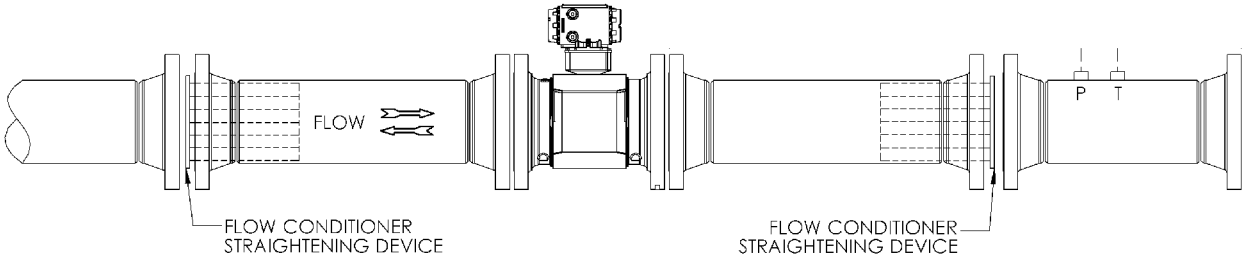
Before pipeline cleaning and maintenance ("pigging operations"), remove straightening vanes or flow conditioners.

Failure to do so may cause excessive pressure in the meter system, resulting in serious injury/ death or equipment damage.

3812 Ultrasonic Flow Meter with flow conditioner for unidirectional flow



3812 Ultrasonic Flow Meter with flow conditioner for bidirectional flow



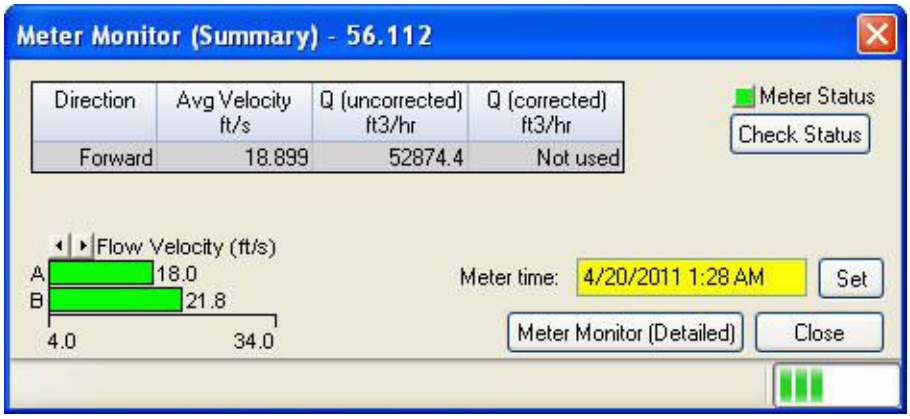
Straightening vanes or flow conditioners **must** be removed during pipeline cleaning maintenance operations ("pigging operation"). if the meter run is pigged with a flow conditioner in line, pressure may build up and cause the pipes and flanges to burst and severely injury personnel. The excessive pressure may damage the meter or the transducer ports may collect debris which may impede data acquisition and flow measurement.

Section 2: Troubleshooting

2.1 Meter status alarms

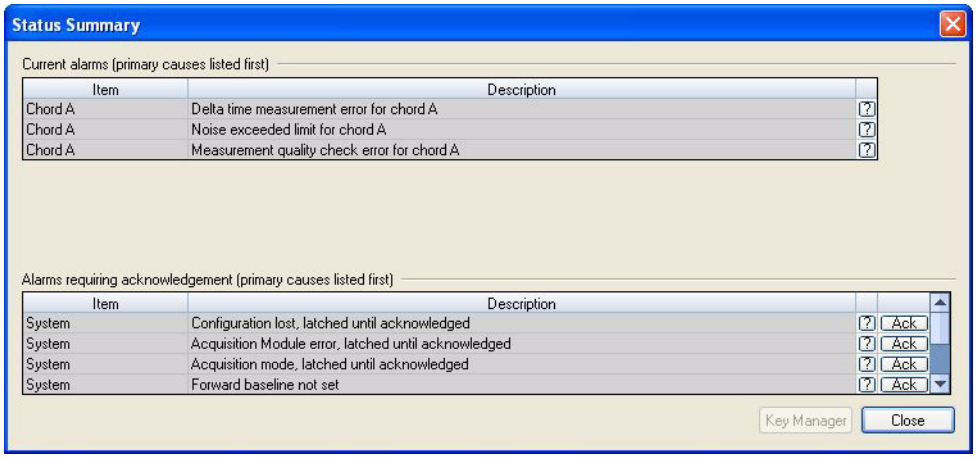
Run Daniel MeterLink and open the Meter Monitor (Summary) view to perform a diagnostics health check.

Figure 2-1 Meter Monitor (Summary) view



If the meter is measuring flow and operating within the calibration parameters the Meter Status LED is green. If the Meter Status LED is red, an active alarm exists that requires you to take corrective action. Click the Check Status button to display the Status Summary screen. The alarms are shown with the primary causes listed first. Click the question mark [?] next to the alarm to display a help topic related to the alarm and recommended actions to resolve the issue.

Figure 2-2 Status Summary



2.1.1 Check status

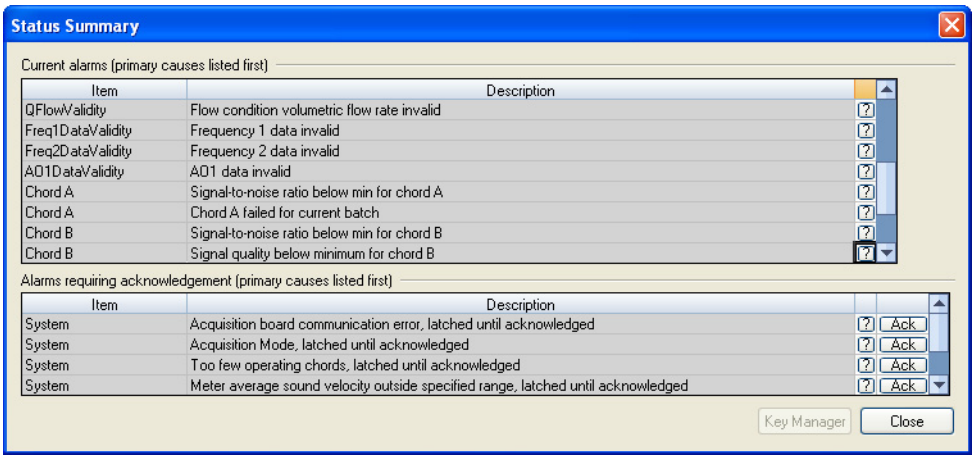
Click the **Check Status** button if any of the LEDs are yellow or red to see more specific information causing the status alarm. Some alarms do not require an acknowledgement and will clear automatically when the alarm condition goes away. Alarms that require a user to acknowledge them will have a button to the right titled **ACK**. Clicking the **ACK** button changes the button text to **Wait** and sends a request to the meter to clear the alarm. The alarm will disappear from the Check Status dialog once the alarm actually clears.

Click the **Check Status** button and Daniel MeterLink opens the Status Summary dialog box that gives a short description of all alarms present.

Figure 2-3 Meter Monitor Status Summary

A.

B.



A. Active alarm conditions from Meter Monitor page
B. Status Summary page with alarm examples

Following is a list and a brief description of the types of alarms:

- System
- Field I/O
- Validity
- Comms
- Check Status

2.1.2 System alarm

The System alarm indicates a failure in the hardware that should be addressed by a service technician. This includes memory checksum errors and communication errors within the hardware. A Red LED indicates a System alarm condition. Collect a Maintenance log and an audit/alarm log and then, contact your Daniel service representative.

2.1.3 Chord A and Chord B alarm

Chord A and Chord B - These alarms indicate how a chord is functioning.

LED Color	Problem
Green	No alarms are present. Chord is operating properly.
Yellow	At least one sample in the batch caused an alarm but it did not cause the chord to fail. The sample will not be used in the batch. Discarding occasional samples can occur during normal operation such as during flow velocity changes.
Red	The chord has failed or is in acquisition. This chord is not used for this batch. Chords that have failed or are shown to be in acquisition for repeated batches indicates that the meter should be inspected by a service technician.
Gray	The chord has manually been set to inactive, or option is not available.

2.1.4 Field I/O alarm

Reports various field I/O devices that are in alarm. Click the **Check Status** button for more details on specific alarms. The field does not appear if the meter does not support this alarm.

2.1.5 Validity alarm

This alarm indicates that the meter may not be measuring accurately. Click **Check Status** to see a description of which validity alarms are active. The validity alarms **QMeter** and **QFlow** indicate an issue with the meter collecting enough information from the chords to make an accurate measurement. The validity alarms for pressure and temperature indicate that the value is above or below the alarm limits for these values. Red and green are the only colors used for this alarm.

2.1.6 Comms alarm

The Comms alarm indicates that communications between Daniel MeterLink and the meter failed. This could be due to a poor communication link. Daniel MeterLink continues to retry communications. Red and green are the only colors used for this alarm.

2.1.7 Communications

The Communications Analyzer (via Daniel MeterLink **Tools> Menu>Communications Analyzer** menu path) displays communications between Daniel MeterLink and the ultrasonic meter. This utility is useful for troubleshooting communications to the meter. It displays many of the TCP/IP commands between Daniel MeterLink and the connected meter.

For troubleshooting communications with the 475 Field Communicator for the HART® Protocol, refer to Section 5 of the *Emerson 475 Field Communicator User's Manual, Rev D*. This manual may be downloaded from the following location:

http://www2.emersonprocess.com/en-US/brands/Field-Communicator/Pages/Documentation.aspx

For troubleshooting communications with AMS Device Manager, refer to the help documentation and support at the following web site:

http://www2.emersonprocess.com/en-US/brands/amssuite/amsdevicemanager/Pages/AMSDeviceManager.aspx

2.2 Troubleshooting the meter

Table 2-1 and the following sections show errors that may occur with the meter hardware, firmware or connections and recommended actions to resolve the problem(s).

Table 2-1 Troubleshooting

Error	Recommended action(s)
Acquisition Module Error	• Check interconnect cable between Acquisition Module and the CPU Module. • Attempt the **Program Download** procedure to install the firmware. – Cycle power to the meter. – Replace the Acquisition Module (see Section 3.4.4). – If the Acquisition Module cannot be reprogrammed, collect a complete Archive log and contact your local area Daniel service representative.
Acquisition Module is not compatible with firmware	• Upgrade the firmware in the meter to the latest version using Daniel MeterLink. Contact your Daniel service representative to obtain the latest firmware. • Replace the Acquisition Module.
Chord failure	• Chord is hard failed (Chord A or Chord B) and meter is unable to obtain measurement data from this pair of transducers. – If Chord A (or Chord B) is failed and no other transducers are failed or are reporting status alerts, the issue is most likely isolated to this pair of transducers or its cabling. Check the transducer wiring for this pair of transducers to make sure connections are secure and wired correctly. – Verify that the meter run is not partially full where the top transducer pair is not submerged in the process fluid. – Verify the average gain of this transducer pair is not above 90dB. The gain value can be read in Daniel MeterLink on the Monitor page. – Remove the transducer cable from the transducer and measure the resistance with an Ohm meter across the two pins on the back of the transducer housing. If the value is over 2 ohms, replace the transducers. – If transducer cabling allows, swap cabling of failed transducer pair with a pair with equal path lengths. If the alarm remains active for this chord, then the transducers are working properly. If this alarm clears but the chord that was swapped now fails, the issue is with the transducer. – Collect a Maintenance Log, Configuration file and Waveform stream file with Daniel MeterLink and contact your Daniel service representative.
CPU Module LINK LED	• When connecting directly: – Use a cross-over cable connection (P/N 2-3-3400-079) • When Using a Hub: – Use straight-through patch cable between the meter and the hub and a straight-through patch cable between the hub and the PC – Do not connect either the meter or PC to the hub UPLINK port – Check the CPU Module LED 1 is on (either solid red or flashing green). If the LED is not on, check power to the meter. – If the LED is on, check the Ethernet cable connections

Table 2-1 Troubleshooting

Error	Recommended action(s)
CPU Module LINK LED is on but I can't communicate with the meter using Ethernet	• If you are connecting for the first time, refer to Section 3.5 for instructions on initial communication (via Ethernet) setup • Enable the DHCP switch on the CPU Module • Verify that the PC has received an IP address from the meter as follows: – bring up DOS prompt window (Start->Run->(type)cmd) – in the DOS prompt window, type ipconfig • If you get the following: IP 192.168.135.35 (note: the last .35 can be up to .44) with a Subnet Mask of 255.255.255.0 and Default Gateway you should be able to connect to the meter • If you get the following: – Ethernet adapter Local Area Connection 1: – IP Address: 0.0.0.0 – the PC has not yet received an IP address from the DHCP server wait (up to 30 seconds) to receive an IP address before attempting to connect to the meter – after 30 seconds the PC has not received an IP address from the DHCP server or the IP address shown above (from ipconfig) is different from the range of 192.168.135.35 through 192.168.135.44, verify that the PC is configured to receive its IP address automatically (via DHCP)
Communication line connected to the flow computer but no signal is received	• Check for loose connections at the flow meter and the flow computer. • Check the CPU Module settings.
Communicating with meter but all chords display failures	• Verify that the resistance of transducers is within specification (2 MΩ). • Check the Acquisition Board. • Check the interconnect cables between the Base Enclosure and the Transmitter Electronics Enclosure.
Cannot communicate with Daniel MeterLink program	• Ensure that the meter is properly powered. • Ensure that the computer cable is properly connected and check your interface pins (RS-485 or RS-232). • Verify that the communication parameters of the Daniel MeterLink program are correctly set. • Check RS-485 or RS-232 communication.
Cannot communicate with 475 Field Communicator	• Refer to the *Emerson 475 Field Communication User's Manual*, Rev D. This manual may be downloaded from the following location: http://www2.emersonprocess.com/en-US/brands/Field-Communicator/Pages/Documentation.aspx – Note: The 375 Field Communicator is no longer available for purchase since the release of the 475 Field Communicator. Customer support for the 375 Field Communicator remains available.
Cannot communicate with AMS Device Manager	• Refer to the AMS help documentation and support at the following web site: http://www.emersonprocess.com/ams/suppinde.htm

Table 2-1 Troubleshooting

Error	Recommended action(s)
Connect to multiple meters via Ethernet when they are on the same LAN	• Configure each meter with a unique user-specified IP address (following the initial communication quick start instructions (Section 3.5). • Contact your IT department for valid IP addresses for your LAN and Gateway addresses. • Disable the DHCP server.
Connect to multiple meters via Ethernet when they are on the same hub but not connected to an intranet LAN	• Configure each meter with a unique user-specified IP address (following the initial communication quick start instructions (Section 3.5). • Assign each meter on the hub a unique IP address within the range 192.168.135.150 through 192.168.135.254 (Gateway address for each meter may be left unconfigured as 0.0.0.0). • A PC may receive its IP address from an external DHCP server; in this case, one and only one meter must have its DHCP server enabled (the DHCP server will serve up to 10 IP addresses to PCs attempting to talk to all meters on the hub). • Once a meter's IP address is configured, the meter may be connected to the hub and accessed using that IP address.
Configuration changed	• One or more parameters have been modified in the meter's configuration – Collect an Audit log using Daniel MeterLink in order to see what configuration parameters changed and when they changed. – Run the **Tools>Edit CompareConfiguration** utility and click the Write All button or select the checkbox in the value column and click Write Checked button to write the changes to the meter. – Save the configuration file.
Configuration lost	• The meter configuration has reset to default values and the meter is not configured correctly to measure flow and the meter has performed a Cold Start. – Unless the Cold Start occurred after upgrading firmware, replace the CPU Module (see Section 3.4.1). – If the cold start occurred after a firmware upgrade, fully re-configure the meter from a previously saved configuration using the **Tools>Edit/Compare Configuration** in Daniel MeterLink.
Electronics Temperature is Out Of Nominal Range	• Temperature of the electronics is out of nominal operating range (below -40 °C or above 100 °C) which could lead to a system failure. – Attempt to warm or cool the meter electronics housing. – If the electronics is mounted to the meter and the process fluid in the meter is over 65 °C, you must remote mount the electronics off of the meter body. – Collect a Maintenance log using Daniel MeterLink while the meter is experiencing the issue and contact your Daniel service representative.

Table 2-1 Troubleshooting

Error	Recommended action(s)
Flow pressure is outside the alarm limits	• Startup Issues: – Verify that there is voltage to the pressure sensor from either the meter's power supply board or from an external power supply. – If using an analog pressure device, verify that the pressure sensor is properly wired to the connector. – Verify the input is properly configured for your pressure input. – If using a flow computer to write pressure to the meter, verify that it is properly writing to fixed flow pressure in the proper units. • Run Time Issues: – If using an analog pressure device and input reading is 0, check if IsAI2Avail is equal to 1 in the Meter Information dialog in Daniel MeterLink. If it is not 1, either the I/O Board has been removed or is damaged. Reinstall or replace the CPU Module if this value is 0. – If using an analog pressure device, verify that the pressure sensor is working properly. – If using an analog pressure device, recheck wiring and switch settings. – If a flow computer is writing values to the fixed flow pressure, verify that the flow computer is still writing valid values without Modbus write errors. – Reverify the pressure input settings are correct.
Flow temperature is outside the alarm limits	• Startup Issues: – Verify that there is voltage to the temperature sensor from either the meter's power supply board or from an external power supply. – If using an analog temperature device, verify that the temperature sensor is properly wired to the connector. – Verify the input is properly configured for your temperature input. – If using a flow computer to write temperature to the meter, verify that it is properly writing to fixed flow temperature in the proper units. • Run Time Issues: – If using an analog temperature device and input reading is 0, check if IsAI2Avail is equal to 1 in the Meter Information dialog in Daniel MeterLink. If it is not 1, either the I/O Board has been removed or is damaged. Reinstall or replace the CPU Module if this value is 0. – If using an analog temperature device, verify that the pressure sensor is working properly. – If using an analog temperature device, recheck wiring and switch settings. – If a flow computer is writing values to the fixed flow temperature, verify that the flow computer is still writing valid values without Modbus write errors. – Reverify the temperature input settings are correct.

Table 2-1 Troubleshooting

Error	Recommended action(s)
Program download failed during firmware upgrade	• If the meter power fails during a firmware upgrade process, perform a backup upgrade in an attempt to connect to the meter and download the program again. – In Daniel MeterLink go to the **File** pull-down menu and select **Program Settings.** – Enable the **Allow FTP-only** connection – For Serial Port Connections: Connect to Port A. You may need to adjust your Meter Directory settings for the connection so that they match the port default settings. Port A will default to 19200 baud with a Modbus address of 32. – For Ethernet Connections: If you are connecting to the meter over an Ethernet port, you should be able to connect with the same IP address as normal. If this is unsuccessful, the meter may have defaulted to 192.168.135.100 with a subnet of 255.255.255.0. Make sure your PC has a compatible address and attempt a connection using this IP address. – Make sure your cabling and your Meter Directory record are setup attempt to connect to the meter. – You will receive a message "Error 10001 opening database connection to...". Click **OK** and you will be prompted to "Attempt FTP-only connection ....". Click **Yes** and if successful, the Daniel MeterLink caption displays "...Connected to <meter name>...". Go to the **Tools** pull down menu and select **Program Download** to attempt the firmware upgrade again. – If the firmware upgrade is successful, the meter should start working as normally as the meter's configuration is not normally lost. – If the configuration is lost, use Daniel MeterLink **Edit/Compare Configuration** to write the saved configuration back to the meter. The saved configuration files a typically stored in C:\Ultrasonic Data folder. – Restart the meter to install the firmware. Daniel MeterLink prompts you with a message that it must disconnect from the meter. Once the firmware upgrade is complete you will be able to reconnect to the meter with Daniel MeterLink. – When the meter restarts, it takes about two minutes before you will be able to reconnect depending on the firmware upgrade being performed. If the database does need to be reinitialized, it could take up to five minutes. – After an upgrade, it is recommended to reconnect to the meter and repeat the **Program Download** process. – If all the program components are successfully updated, they will show to be the same date and version as the **Currently Installed Versions** and the **Download** button will be disabled. – If one or more components are still not updated, click **Download** to continue the upgrade process.
No power to the unit	• Check that the correct voltage level is in the range of 11-36 VDC at the meter (refer to the System Wiring Diagram in Appendix B). • Check the main power source for blown fuse or tripped circuit breaker (see Section 3.4.2). Reference your "as built" installation drawings for your location.

Table 2-1 Troubleshooting

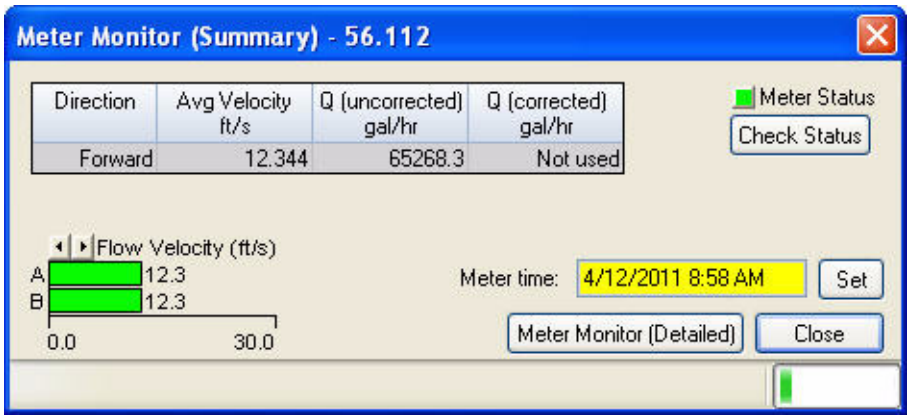
Error	Recommended action(s)
One or more of the chords is not indicating a reading (reporting zeros)	• Check for loose connections at the cable connectors. • Check the resistance of the transducers (should be approximately 2 MΩ). • Problem also may be caused by a bad Acquisition Board or interconnect cable. • Check system status in the Daniel MeterLink program for any flagged errors. • Check the CPU Module. • If Chord A is not indicating, change the transducer cables from Chord B to chord A. If Chord B then fails, the transducers are bad on Chord A.
Power Failure	• Meter has had power removed for a period of time or the meter restarted itself such as after a firmware upgrade. The Audit log in the meter indicates the power fail time. – If this was an unexpected restart of the meter, verify the integrity of the power to the meter and make sure that the voltage level is the in the range of 11-36 VDC at the meter. – If this was a known power fail or restart of the meter, just acknowledge this alarm.
Sound velocity is outside defined limits	• The meter's measured average sound velocity is outside the defined limits. – Verify that all chords are measuring the same Speed of Sound within about 0.15%. Look for alarms that indicate transducer problems and resolve any of these issues. This could include failing transducers, debris buildup on transducers, or incorrectly entered path lengths in the configuration. – If the chords agree, adjust the SSMin or SSMax using the **Field Setup Wizard** in Daniel MeterLink so the meter's average speed of sound falls within these limits (consult with a Daniel service representative before before changing these parameters). – Collect a Maintenance log using Daniel MeterLink and contact your Daniel service representative.
Waveform contains an excessive amount of noise	• Use the Daniel MeterLink **Meter>Signal Analyzer** to increase the StackSize until noise level decreases (settings can be 1 (none) 2, 4, 8, or 16). If increasing the StackSize is not successful, try turning on the filter or consult with Daniel Customer Service if you are unsure of how stacking a signal can affect the meter's operation.

2.2.1 Meter maintenance

Run Daniel MeterLink and open the Meter Monitor (Summary) to view the current health status of your meter.

The Monitor (Summary) includes the direction of flow measurement, velocity rate, units of measurement, uncorrected or corrected flow (if applicable for your meter) and a bar graph for a visual comparison between the velocities for each chord.

Figure 2-4 Meter Monitor (Summary) view



Refer to Table 2-1 for error resolutions and Table 2-2 for meter maintenance hardware diagnostics.

Table 2-2 Maintenance

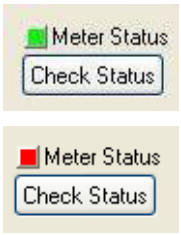
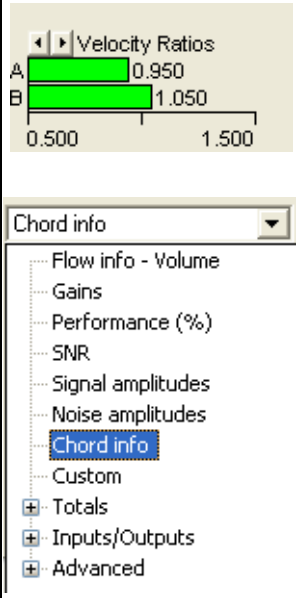
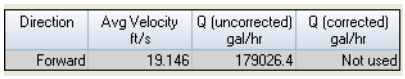
Daniel MeterLink utility	Diagnostics	Action(s)
Meter Monitor (Summary) view	• Check Status for active alarms 	• Meter Status LED is green if there are no active alarms. This indicates the meter is measuring flow and operating within the calibrated parameters. • Meter Status LED is red. This indicates an active alarm. Resolve and acknowledge active alarms as displayed on the Status Summary page. Click the Help button beside the alarm description to display information about the alarm and recommended actions to resolve the issue.
Meter Monitor (Detailed) view	• Flow Profile 	• Flow profile velocity for Chords A and B shown on the Bar graph should be of equal lengths and at 3 ft/s should be 1.0 (range of 0.95 to 1.05 indicates a good flow profile velocity). • If the velocity ratiois greater than a 10% differential between chords, a degradation in the symmetry is indicated. • Check for a chord failure and resolve this and clear the alarm. • If installed, check the flow conditioner for blockage. • Compare gains and Signal to Noise (SNR) ratios decibel values with the meter calibration values in the Maintenance log Inspection report. • The meter may not be in measurement mode or there are too few operating chords. • Check chord average signal amplitudes with the meter baseline values in the Maintenance log Inspection report.
Meter Monitor (Summary) view Meter Flow Properties Table	• Flow velocity 	• Check the flow direction. If reverse flow is detected, check for valve leaks. • If the meter run typically has reverse flow when flow is stopped, use the **Field Setup Wizard >General Page** and reconfigure the ReverseFlowVolLmt to allow a higher volume.

Table 2-2 Maintenance

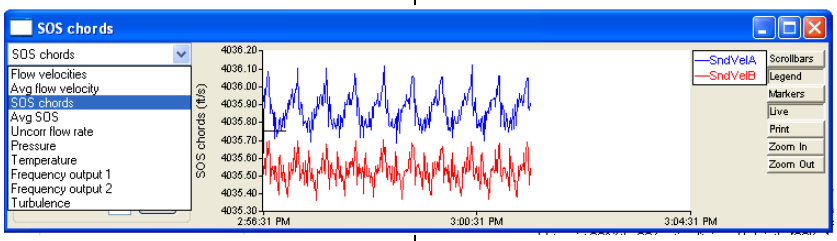
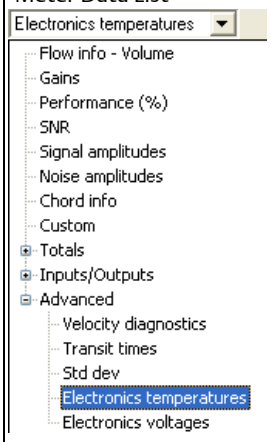
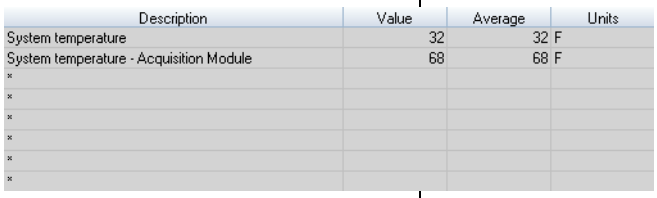
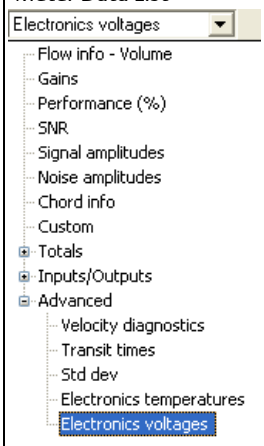
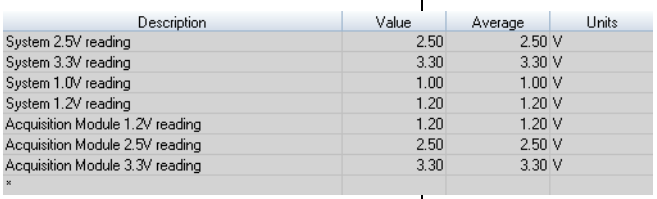
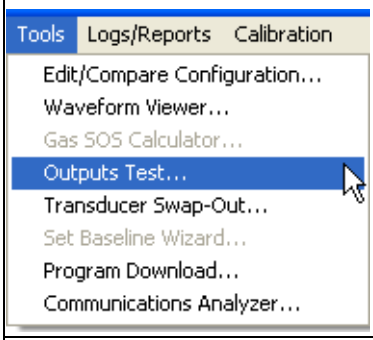
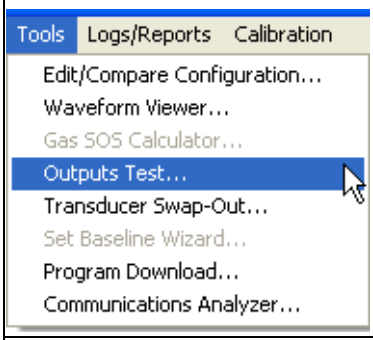
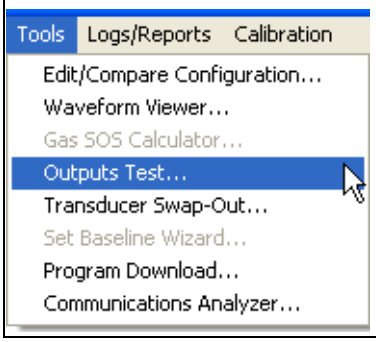
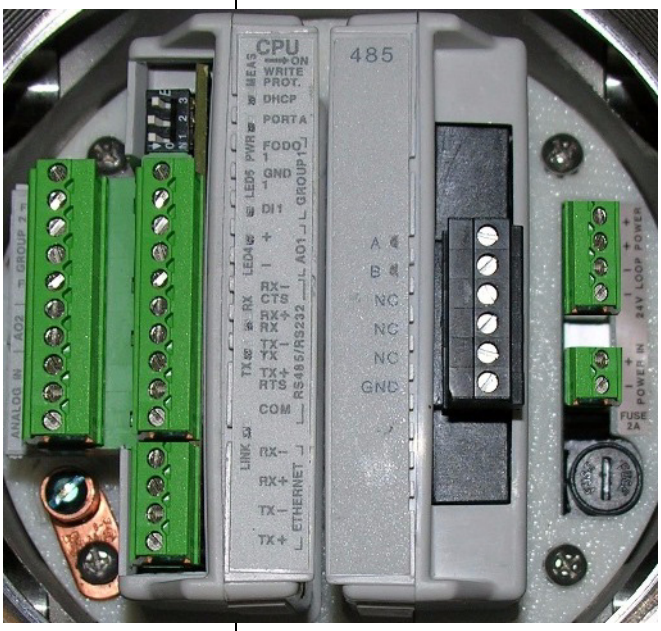
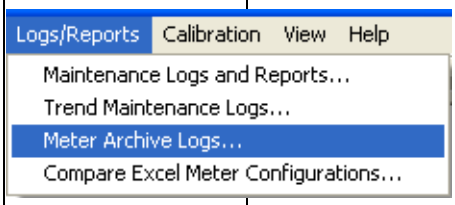
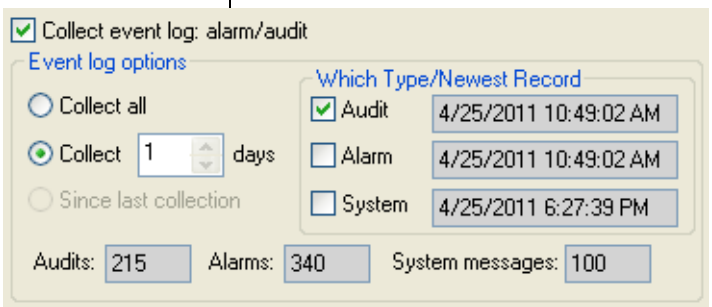
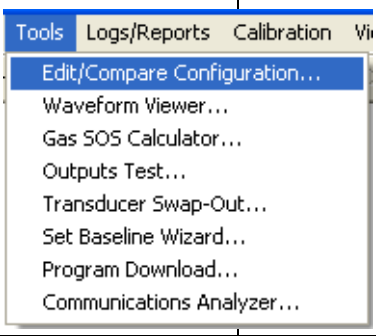
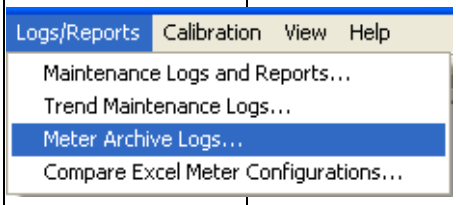
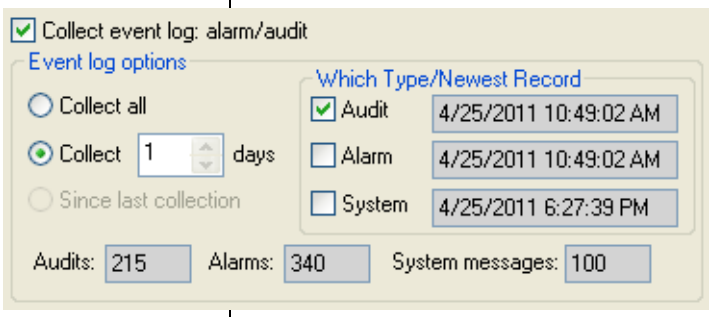
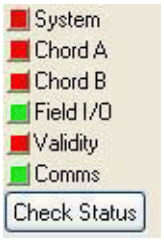
Daniel MeterLink utility	Diagnostics	Action(s)
Meter Monitor (Detailed) view Monitor Chart Selection list 	• Speed of Sound	• Compare Speed of Sound deviation from measured SOS relative to the average SOS. • Check the chord's SOS. • Check and correct geometry configuration (pipe diameter, distance between the transducers (LA), and delay time). • If present, resolve transducer issues (failed transducer, cabling or debris buildup on the transducer face, or path length configured incorrectly). • Adjust SSMin or SSMax (consult a Daniel Service representative before making these adjustments).
Meter Monitor (Detailed) view Meter Data List 	• Electronics temperature out of range 	• Temperature of the electronics is out of nominal operating range below -40 °C or above 100 °C (-40 °F or above 212 °F). – Heat or cool the meter electronics housing. If operating temperature exceeds 65°C, remote mount the Transmitter Electronics Enclosure.
Meter Monitor (Detailed) view Meter Data List 	• Electronics voltage out of range 	• CPU board system voltages are valid if 1.0V, 1.2V, 2.5V, 3.3V or the Acquisition Module valid voltages are 1.2V, 2.5V or 3.3V. • Replace the CPU Module if one or more of the System Voltages is out of range. • Replace the Acquisition Module if one or more of the voltages is out of range.

Table 2-2 Maintenance

Daniel MeterLink utility	Diagnostics	Action(s)
MeterLink Tools Menu 	• Frequency output	• Run the Frequency Outputs test. • If the output reads zero, you may require a pull up resistor 1.2kOHM, 0.5W. • Check frequency output from minimum to maximum values.
MeterLink Tools Menu 	• Analog outputs	• Run Analog Outputs test and verify outputs are within 4mA -20mA range – 0% = 4mA – 25% = 8mA – 50% = 12mA – 75% = 16mA – 100% = 20 mA
MeterLink Tools Menu 	• Digital outputs	• Run Digital Outputs test. • Digital Output Content is in relation to frequency validity and flow direction configuration and polarity.

Meter Hardware	Diagnostics	Action(s)
Meter Electronics 	• Acquisition Module communications error	• If the CPU Module LED 5 is not flashing green, check interconnect cable between Acquisition Module and the CPU Module. • Check firmware revision and upgrade if necessary using Daniel MeterLink Tools>Program Download. • If the CPU Board LED 5 is not flashing green, replace Acquisition Module (see Section 3.4.4).
MeterLink Logs/ Reports Menu  	• Meter performed a Warm start or a warm start is required	• Meter performed a Warm Start: – Collect an Archive event log (Audit log) using Daniel MeterLink to view configuration parameters changes and when they changed. • Warm start required: – When you make changes to the transducer characteristics, sample rates, the device number, or a Modbus map file.

Meter Hardware (Continued)	Diagnostics	Action(s)
MeterLink Tools>Edit/ Compare Configura-tion Menu 	• Meter performed a Cold Start	• The meter configuration has reset to default values and the meter is not configured correctly to measure flow. • Unless the cold start occurred after upgrading firmware, you may need to replace the CPU Module. • If the Cold Start occurred after a firmware upgrade, you must reconfigure the meter from a previously saved configuration file using the Edit>Compare Configuration screen. Then clear the latched alarm on the Status Summary page.
MeterLink Logs/ Reports Menu  	• Power failure	• If this was a known power fail or restart of the meter just acknowledge this alarm on the Status Summary page. • If this was an unexpected restart of the meter, verify the integrity of the power to the meter and make sure that the voltage level is in the range of 11-36 VDC at the meter. • Collect an Archive event log (Audit log) using Daniel MeterLink.
Daniel MeterLink Meter Monitor (Summary) view	• Chord Failure 	• The meter is unable to obtain measurement data from a pair of transducers. • The cause may be isolated to one pair of trans-ducers or its cabling. Check the transducer wiring for this pair of transducers to make sure connections are secure and wired correctly. • Verify that the meter run is not partially full where this top transducer pair is not submerged in the process fluid. • Verify the average gain of this transducer pair is not above 90dB. Read the value from the Daniel MeterLink Monitor Page or using AMS under Service Tools>Path performance. • Remove the transducer and clean the trans-ducer face. Reapply coupling fluid to the transducer face and reinstall (see Section 3.2.1 Transducer removal procedure).

Meter Components	Visual Inspection	Action(s)
Security seals	• Endcap seals • Endcaps latches • Transmitter Electronics Enclosure • Base Enclosure • Shroud seals	• Only authorized personnel may remove security seals. Follow your standard operating procedure to report seals that have been tampered with or removed and replace the seals per instructions in Section 3.6.8 in the Installation Manual (3-9000-765).
External ground wiring	• Transmitter Electronics Enclosure ground lug	• Inspect ground lug wiring and make sure the wiring is tightly secured.
Conduit seals	• Transmitter Electronics Enclosure	• Inspect the conduit sealant and follow your standard operating procedure to report tampering with the conduit sealant. • Your operating procedures may require a certified electrician and company witness to reseal the conduit.
Flanges	• Inspect for leaks	• Perform leak tests on flanges

2.2.2 Unable to connect direct serial or external serial modem

If you are using Windows® XP, Windows® Vista or Windows® 7 make sure that you do not have more than one modem driver installed to the same COM port. Typically this will only be necessary if you use one COM port to talk direct (serial communications) and use the same COM port to connect to an external modem. This is an apparent limitation in Microsoft's® Dial-up Networking. If more than one modem driver is installed for a particular COM port, Dial-up Networking will always use the last driver installed regardless of what is selected. The only work around is to only install one modem driver per COM port on the PC at a time. Refer to the Daniel MeterLink Quick Start Manual (P/N 3-9000-763) for phone and modem details. The manual may also be downloaded from the Daniel website.

http://www2.emersonprocess.com/en-US/brands/daniel/Flow/ultrasonics/Pages/Ultrasonic.aspx

2.2.3 Unable to connect to meter

If you receive the error message "Unable to connect to meter" when trying to connect to a Daniel Liquid Ultrasonic Flow Meter, refer to the following:

- Ethernet Connections (Section 2.2.4)
- Direct Serial Connections (Section 2.2.5)

2.2.4 Ethernet connections

If you received the error message "Unable to connect to meter" while trying to connect over Ethernet, verify you have the correct IP address in the Meter Directory record. If the meter is to assign the IP address, make sure the IP address is set to 192.168.135.100 and that the DHCP switch is **ON** position on the CPU Module. If the meter has a fixed IP address, verify the IP address, Subnet, and Gateway are correct in the meter. Verify your wiring to make sure you have a cross-over cable for a direct connection between the meter and the computer. If going through a hub, verify that the computer and meter are connected to the hub with straight-through patch cables.

2.2.5 Direct serial connections

Verify the switch settings on the CPU Module. Also verify your wiring between the meter and the computer running Daniel MeterLink using the Field Wiring drawing DMC-004946. Verify the Comms Address and Baud rate are correct in the Meter Directory record. If unsure of the port settings for Port A on the CPU module, you can change the PORT A switch on the CPU module from OFF to ON and the port will be forced to RS-232, 19200 baud rate, Modbus ID =32 for two minutes.

For additional information on wiring and configuring the meter for the various communication options, refer to the Installation Manual (P/N 3-9000-765).

2.3 Troubleshoot Maintenance log files and trend files

2.3.1 Files do not appear in workbook

Maintenance Log files and Trend files that exist on the PC do not appear in the Microsoft® Excel® workbooks tree under Trend Maintenance Logs.

This is most likely caused by the fact that the desired file or files are already open in Microsoft® Excel®. Open files can not be verified as Maintenance Log files or Trend Files by Daniel MeterLink and are left out of the list. Simply close the files in Microsoft® Excel® and then close and reopen the Trend Maintenance Logs dialog box to include them in the list.

2.3.2 Microsoft® Excel® Log/Export options are not available

In order for the Excel® log/export options to be available, Excel® 2000 or later must be installed on the machine and at least one printer must be installed under the Windows® operating system.

If Excel® 2000 or later is installed and you have printers installed but the Excel® option is still unavailable, it may be because Excel® cannot access the printer driver information of the Windows® default printer. If the Windows® default printer is a network printer and you are not currently connected to the network, then Excel® will most likely not be able to access the printer driver information and Daniel MeterLink cannot use Excel® to generate reports or logs.

One solution is to install a local printer on your machine tied to LPT1. The local printer driver you installed can be for any printer and the printer does not actually have to exist or be connected to the PC. If you install a local printer, you can configure Daniel MeterLink to temporarily change your Windows® default printer over to this local printer while running Daniel MeterLink. Do this by selecting this local printer for the Override system default printer selection in the Program Settings dialog. Daniel MeterLink will automatically change the Windows® default printer to the selected override printer when it starts and will set the Windows® default printer back to its original printer when it closes.

2.3.3 Maintenance Logs or Trend files are not created

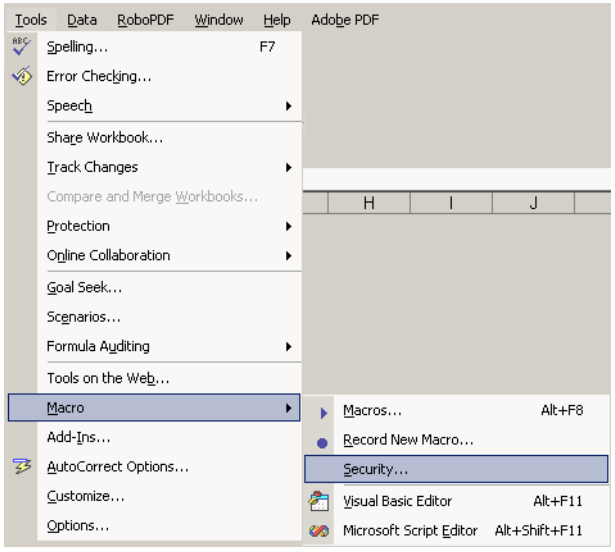
When using Excel® XP or later, some of the worksheets in the Maintenance Logs or Trend files are not created.

If the Inspection sheet of the Maintenance Log file or the Charts sheet of a Trend files is not generated, it is probably because Excel® is not configured to allow Daniel MeterLink to run the Visual Basic® script that generates the page. Excel® can be configured to allow Daniel MeterLink to run the Visual Basic® script by following the instructions below.

To enable Excel® 2000 to work with Daniel MeterLink,

1. Select **Tools>Macros>Security** menu path.

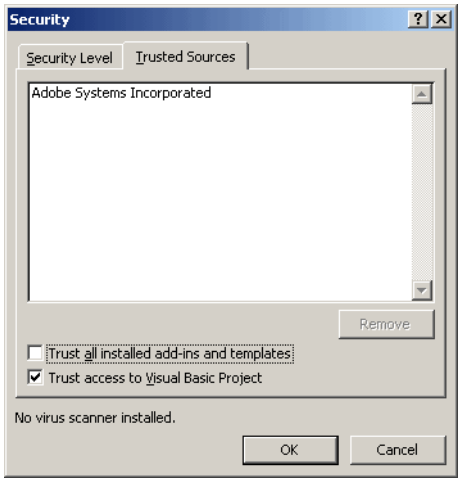
Figure 2-5 Excel® 2000 Tools Menu



2. The Security dialog appears. Select the **Trusted Sources** tab.

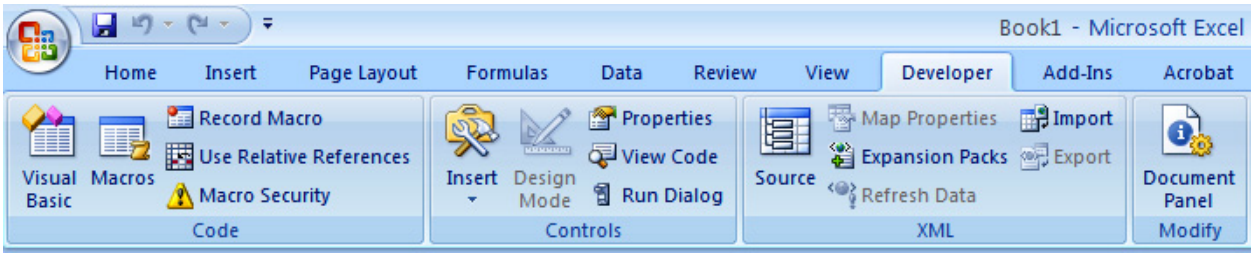
3. Click the **Trust access to Visual Basic Project** radio button and click **OKAY** to apply your selections.

Figure 2-6 Excel® Trusted Access Setting



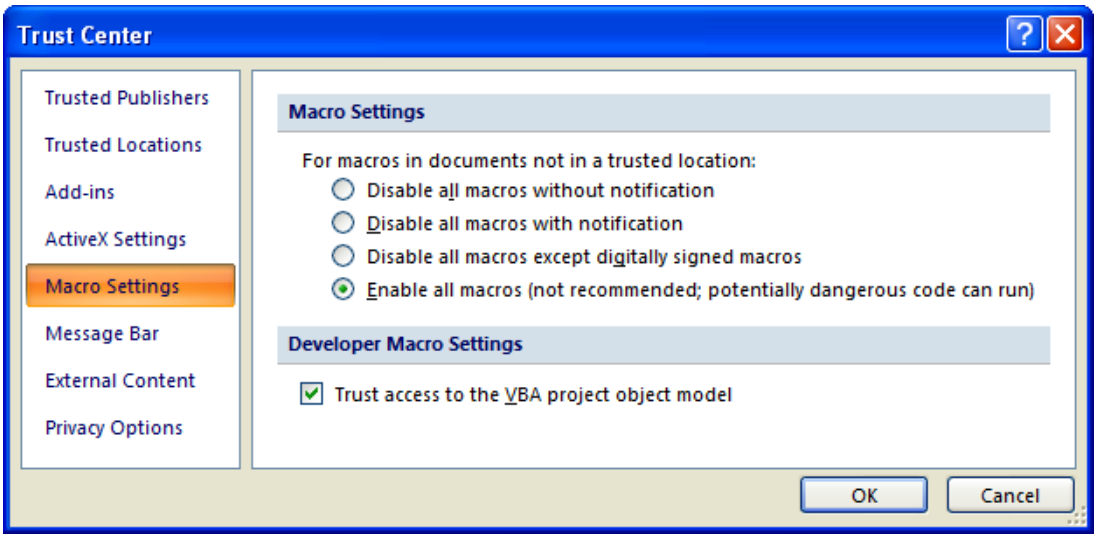
To enable Excel® 2007 to work with Daniel MeterLink customize the Ribbon to include the Developer tab,

Figure 2-7 Excel® 2007 Tools Menu



1. Select Macro Security to access the Trust Center.

Figure 2-8 Excel® 2007 Developer tab - Macro Security



2. Select Macro Settings from the left panel, then click the Enable all macros (not recommended; potentially dangerous code can run) radio button.
3. Place a check mark in "Trust access to the VBA project object model".
4. Click **OK** to apply the changes and close the Trust Center dialog.

2.3.4 Windows® XP with Security Update

The Security Update for Windows® XP (823980) has a problem that causes the Show only maintenance log and trend workbooks check box in Daniel MeterLink to be ineffective.

See http://www.microsoft.com/downloads/en/details.aspx?FamilyID=2354406c-c5b6-44ac-9532-3de40f69c074

Additionally, it may take longer to validate a workbook when you attempt to add it to the Workbooks to trend list. This is a known Issue documented in the Microsoft® Knowledge Base Article 824136 Windows® Explorer Quits Unexpectedly or You Receive an Error Message When You Right-Click a File. For Windows® XP, simply install Service Pack 2 for Windows® XP to resolve the issue. It is not necessary to take action on this issue to use the Trend Maintenance Logs dialog, but you should be aware of possible slow downs if the issue is unresolved.

Section 3: Meter maintenance

3.1 Maintenance

This section includes discussion of the maintenance of Daniel 3812 Liquid Ultrasonic Flow Meters.

⚠CAUTION

SURFACE TEMPERATURE HAZARD

Meter body and piping may be extremely hot or cold

Wear personal protective equipment when coming in contact with the meter. Failure to do so may result in injury.

⚠CAUTION

TRANSPORTATION HAZARD

When moving the meter, do not insert the forks of a forklift into the bore.

Inserting the forks may cause the meter to become unstable, resulting in injury or damage to the bore and sealing face.

⚠CAUTION

TRIPPING HAZARD

Clear all obstacles or obstruct.ions from the work area when transporting, installing or removing the meter.

Failure to clear the work area may cause injury to personnel.

NOTICE

Prior to lifting the unit, refer to the Daniel 3812 Liquid Ultrasonic Flow Meter nameplate or outline dimensional (general arrangement) drawing for the assembled weight.

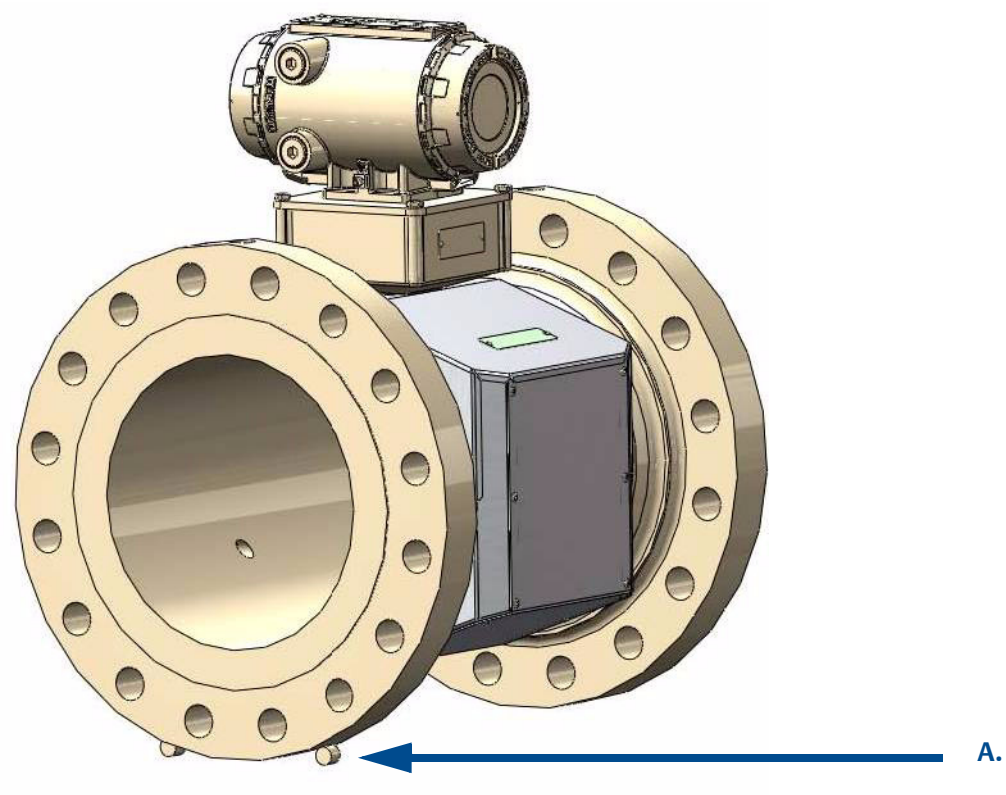
⚠WARNING

CRUSHING HAZARD

Do not remove flange stabilizers

Attempting to do so may allow the meter to roll, resulting in serious injury or equipment damage.

Figure 3-2 Flange stabilizers



A. Flange stabilizers

⚠WARNING

FLUID CONTENTS MAY BE UNDER PRESSURE

When the meter is under pressure, DO NOT attempt to remove or adjust the transducer housing.

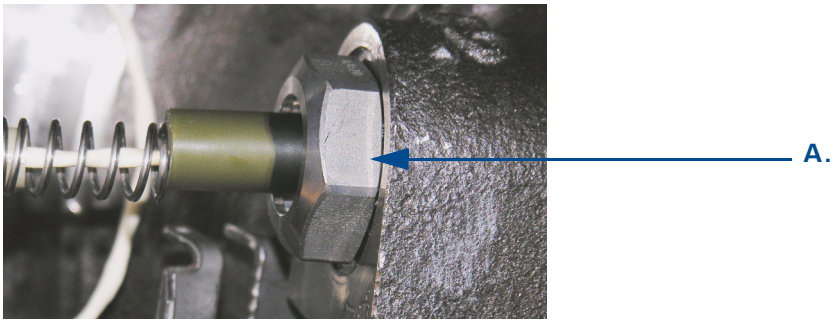
Attempting to do so may release pressurized fluid, resulting in serious injury or equipment damage.

⚠WARNING

FLUID CONTENTS MAY BE HAZARDOUS

The meter must be fully depressurized and drained before attempting to remove the transducer housing. If fluid begins to leak from the transducer housing, immediately reinstall it.

Failure to do so may cause serious injury or equipment damage.



A. Transducer housing

⚠ CAUTION

ESCAPING FLUIDS HAZARD

The purchaser of the meter is responsible for the selection of Daniel components/seals and materials compatible with the chemical properties of the measurement fluid.

Failure to select suitable meter components/seals may cause escaping fluids, resulting in injury or equipment damage

⚠ WARNING

CRUSHING HAZARD

During meter installation or removal, always place the unit on a stable platform or surface that supports its assembled weight.

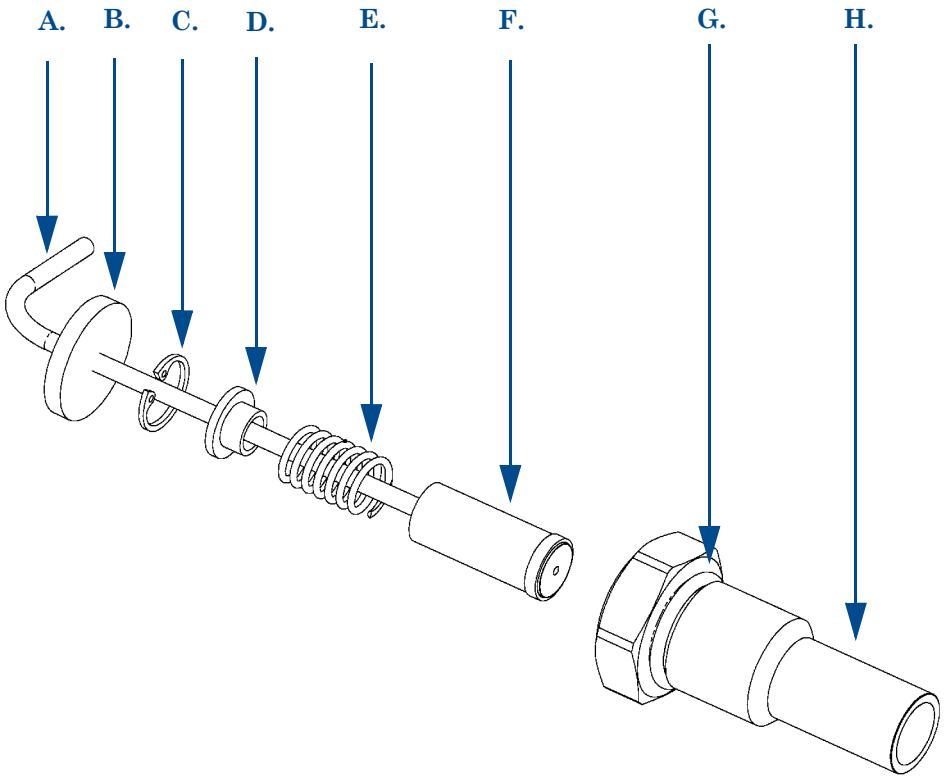
Failure to do so could allow the meter to roll, resulting in serious injury or equipment damage.

3.2 Transducer field removal and installation procedure

The LT-10 and LT-11 transducers have a spring loaded assembly with the piezoelectric element at one end and the electrical connection at the other end. Meters are supplied with transducers which are extractable while the line is pressurized. The transducer assembly shown below is a one-piece capsule that can be easily installed or removed from the meter without depressurizing the unit using the tool list provided in Figure 3-4.

LT-10 transducers are designed for 4 inch to 10 inch meter sizes and LT-11 are designed for 12 inch and larger meters sizes.

Figure 3-3 LT-10 and LT-11 transducer assembly



A. Transducer cable (P/N 1-504-90-129) (max. length 15 ft.)
B. Feed-thru cable seal (P/N 1-504-90-178)
C. Retaining ring (P/N 1-504-08-009)
D. Shoulder washer (P/N 1-504-90-181)
E. Spring (P/N 1-504-90-046)
F. Transducer capsule (LT-10 P/N 1-360-01-624) or (LT-11 P/N 1-360-01-823)
G. O-ring (part numbers vary)
H. Transducer housing (P/N 1-360-01-632 for 316L SS or P/N 1-360-01-633 Inconel)

3.2.1 Transducer removal

⚠WARNING

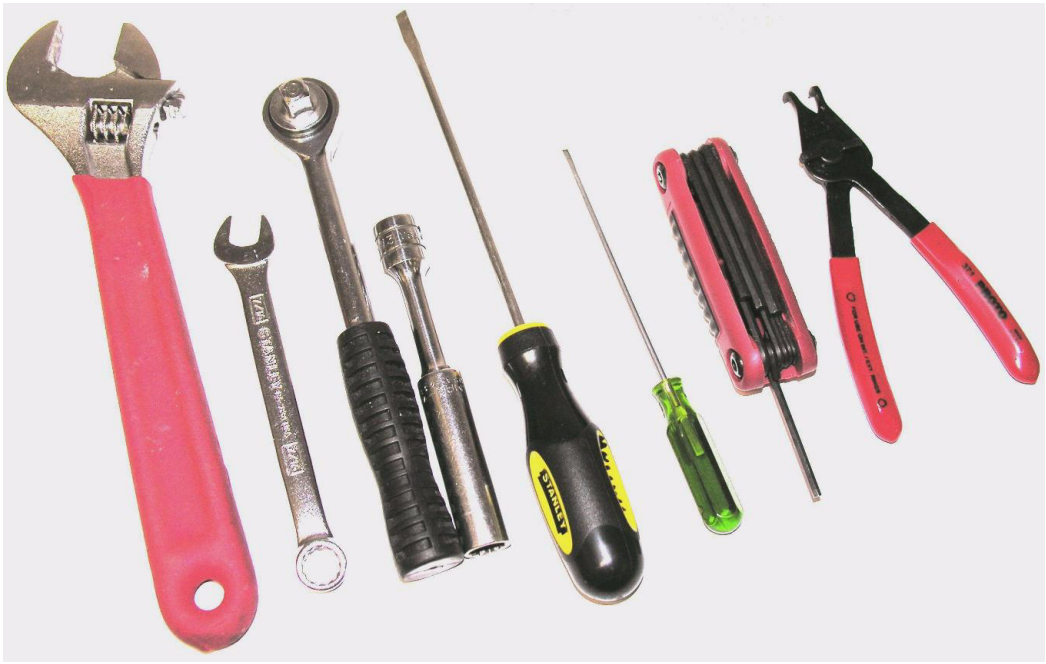
CUTTING HAZARD

Sharp edges may be present on the meter.

Wear appropriate personal protective equipment when working on the meter. Failure to do so may cause serious injury.

Tools required:

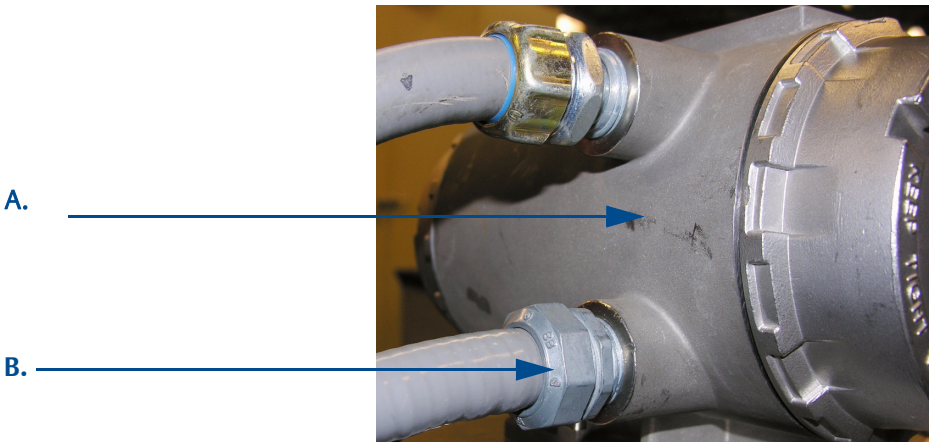
Figure 3-4 Tools required



A. Crescent wrench or channel lock pliers for cable glands and electrical conduit
B. 7/16 inch wrench (12 mm)
C. 3/8 inch drive ratchet wrench (10mm)
D. 3/8 inch drive (10mm) - at least 3.5 inch extension (89mm) with 7/16 (12mm) socket wrench
E. 1/4 inch (7mm) flat-blade screw driver
F. 1/8 inch (3mm) flat-blade screw driver (3mm)
G. Allen wrench - size 3mm (Daniel P/N 2-4-9200-501)
H. Retaining ring pliers (Daniel P/N 1-504-90-043)

1. Remove power to the meter.
2. If the installation has rigid conduit, use a medium size crescent wrench and loosen the hex nuts on the Transmitter Electronics Enclosure. This should allow enough slack to remove the Transmitter Electronics Enclosure from the Base Enclosure. If the installation uses flexible conduit, you may not need to disconnect it from the Transmitter Electronics Enclosure.

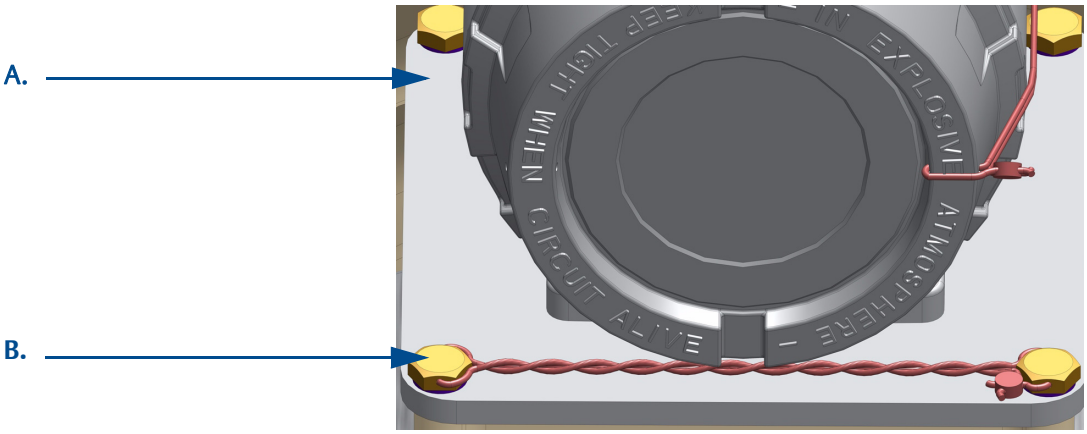
Figure 3-5 Conduit removal



A. Transmitter electronics enclosure
B. Conduit bolts

3. If the meter is equipped with security seals, remove the seals from the bolts on the Base Enclosure.

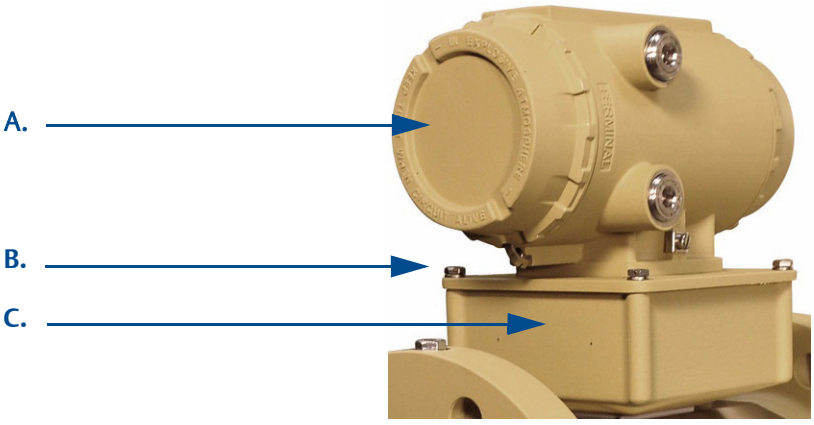
Figure 3-6 Transmitter Electronics Enclosure and Base Enclosure security seal removal



A. Transmitter electronics enclosure
B. Base enclosure bolts and security seals

4. Use a 7/16 inch (12mm) wrench and remove the four hex head bolts and split lock washers securing the Transmitter Electronics Enclosure to the Base Enclosure.

Figure 3-7 Transmitter Electronics Enclosure removal



A. Transmitter electronics enclosure
B. Base enclosure bolts
C. Base enclosure

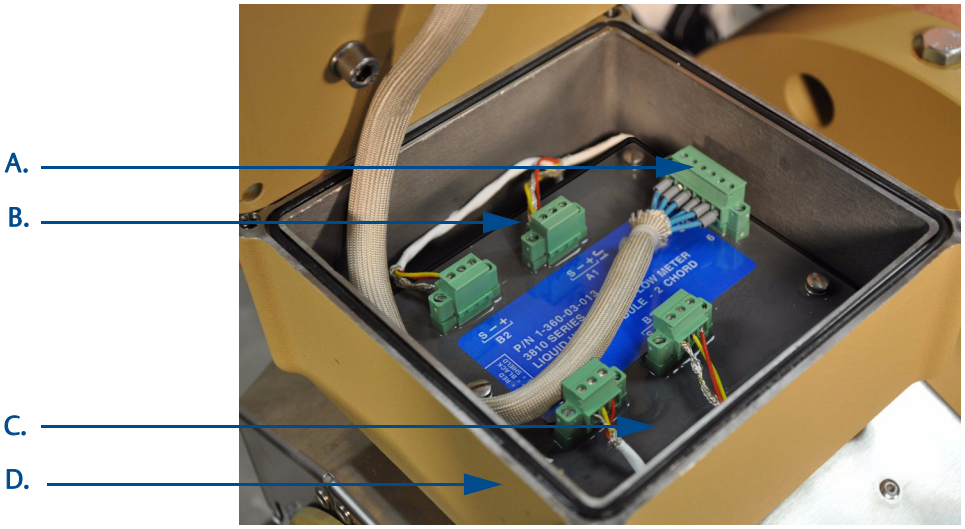
5. Lift the Transmitter Electronics Enclosure off of the Base Enclosure to expose the Acquisition Module wiring. Prop the Transmitter Electronics Enclosure on top of the Base Enclosure and prepare to disconnect the Acquisition cable and transducer terminal blocks.

6. Use a 1/8 inch (3mm) flat blade screw driver to remove the Acquisition cable terminal block screws. Unplug the Acquisition cable terminal block.
7. Use a 1/8 inch (3mm) flat blade screw driver and remove the transducer wire terminal blocks screws. Disconnect the transducer wires from the terminal blocks so that the cables can be removed from the meter.

NOTICE

Make sure the transducer cables are labeled for the chord configuration (A1, A2, B1 and B2).

Figure 3-8 Acquisition Module cable and transducer wiring

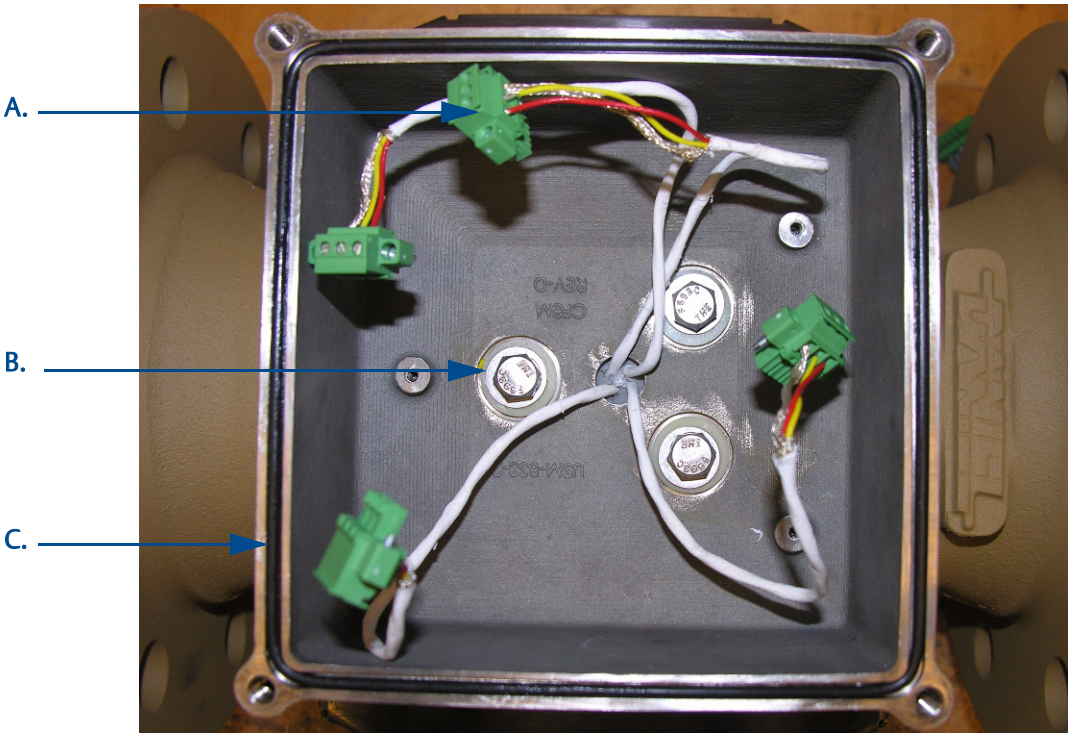


A. Acquisition cable and terminal block
B. Transducer wiring and terminal blocks
C. Acquisition Module
D. Base Enclosure

8. Use a 1/4 inch (7mm) flat blade screw driver and remove the three Acquisition Module flat head screws, split lock washers, and flat washers then remove the Acquisition Module from the Base Enclosure.

9. Use a 7/16 inch (12mm) socket wrench and remove the three Base Enclosure hex head bolts, shoulder washers, flat washers and split lock washers and then remove the Base Enclosure from the meter body.

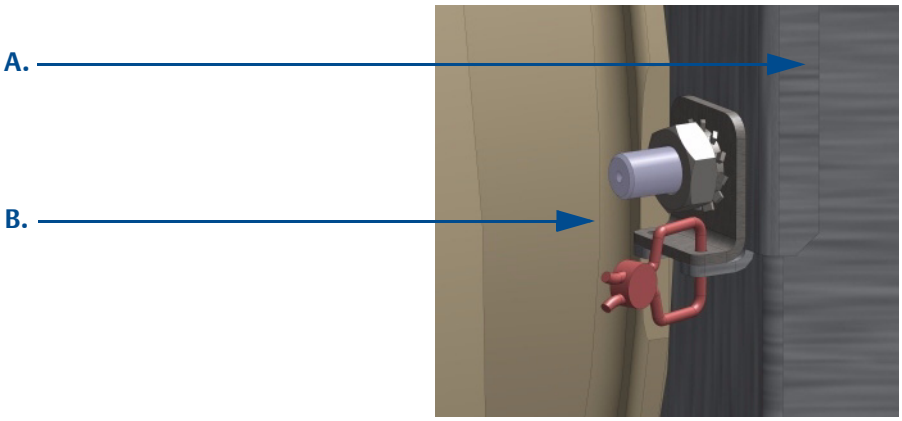
Figure 3-9 Base Enclosure removal



A. Transducer wiring terminal blocks
B. Hex hex bolts
C. Base Enclosure o-ring

10. Remove the security seals from the Lower Shroud on the meter body.

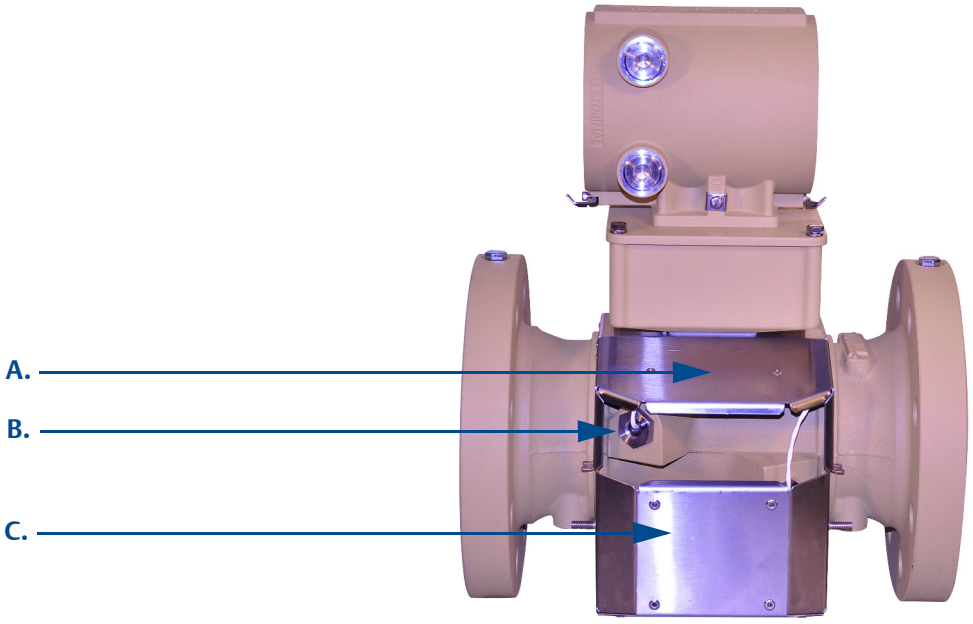
Figure 3-10 Shroud security seal removal



A. Lower Shroud
B. Lower Shroud cover, hex head nuts, lock washers and Shroud clamps

11. Use a 7/16 inch (12mm) wrench and remove the four Shroud hex nuts, external tooth lock washers and Shroud clamps. Then, slide the lower Shroud down to remove it from the meter body.

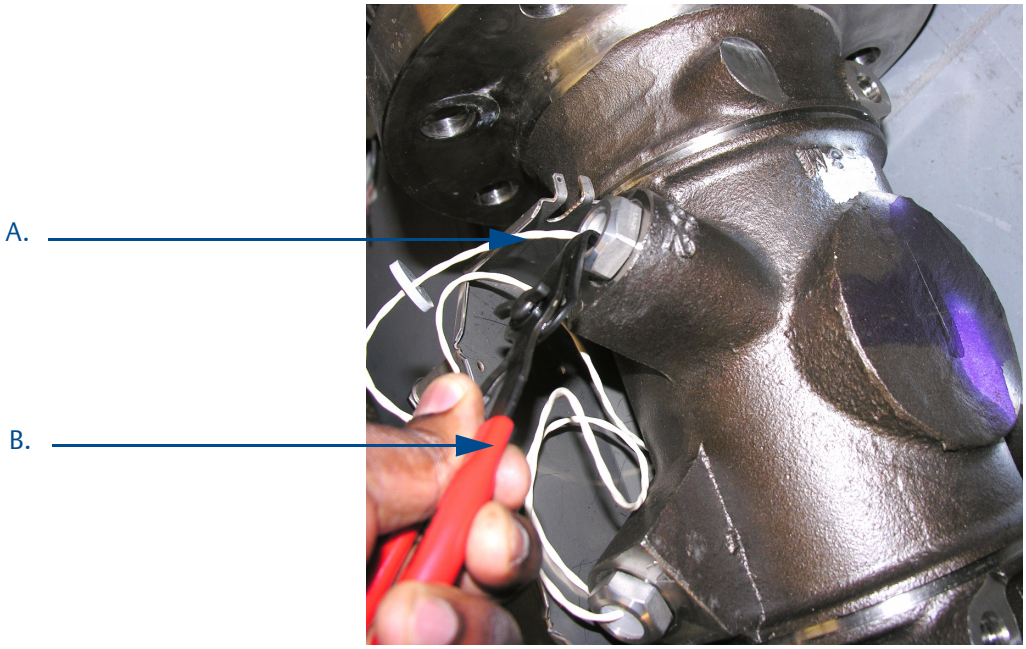
Figure 3-11 Shroud removal



A. Upper Shroud
B. Transducer housing
C. Lower Shroud cover

12. Use Retaining Ring pliers (Daniel P/N 1-504-90-043 or Stanley Proto #J371 or #371L) to pull the transducer cable Feed-thru foam seal from the transducer housing.

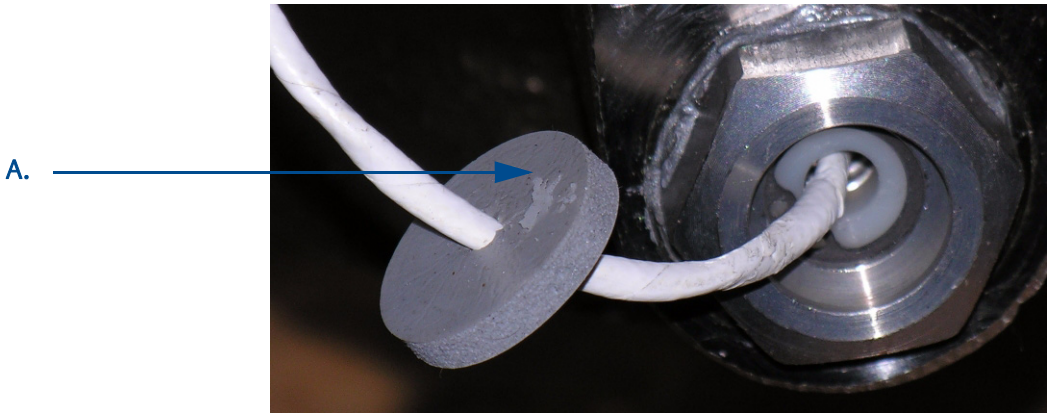
Figure 3-12 Transducer and cable disassembly



A. Feed-thru cable seal removal
B. Retaining ring pliers

13. Slide the Feed-thru seal down the cable.

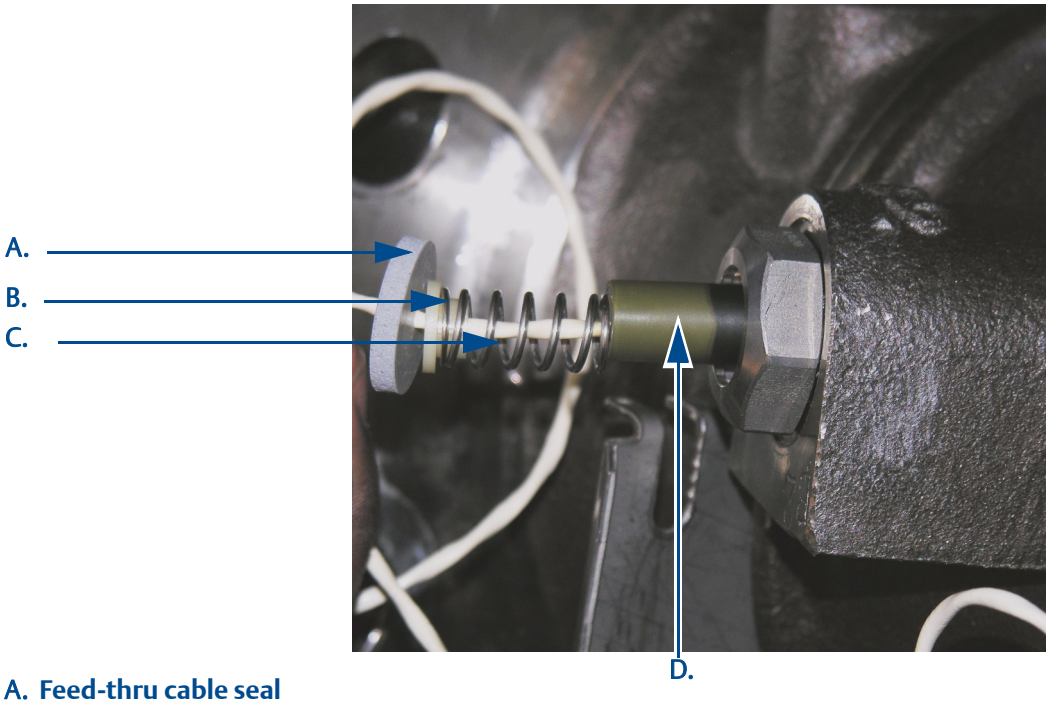
Figure 3-13 Feed-thru cable seal removal



A. Feed-thru cable seal

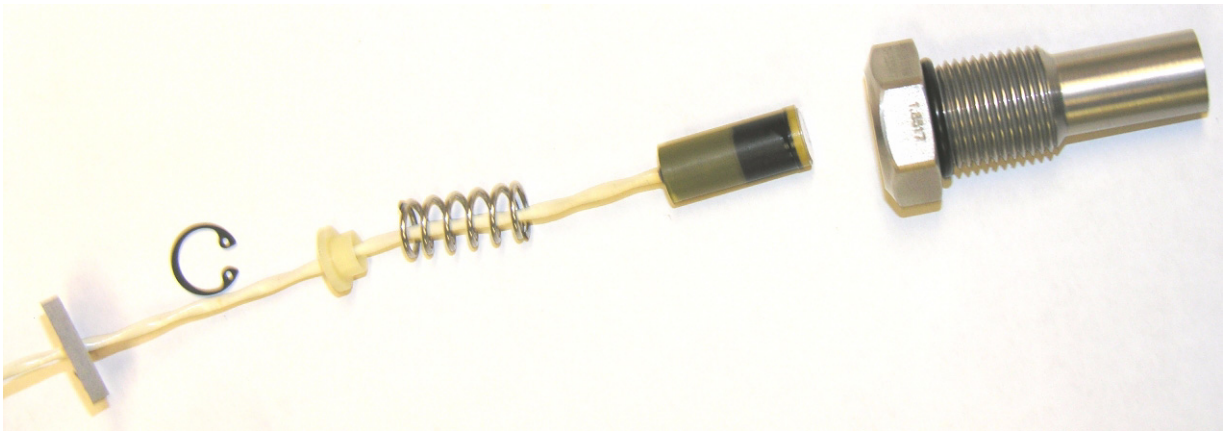
14. Use the Retaining Ring pliers and remove the retaining ring, shoulder washer, and spring from the transducer housing.
15. Pull the transducer capsule from the housing.

Figure 3-14 Transducer removal



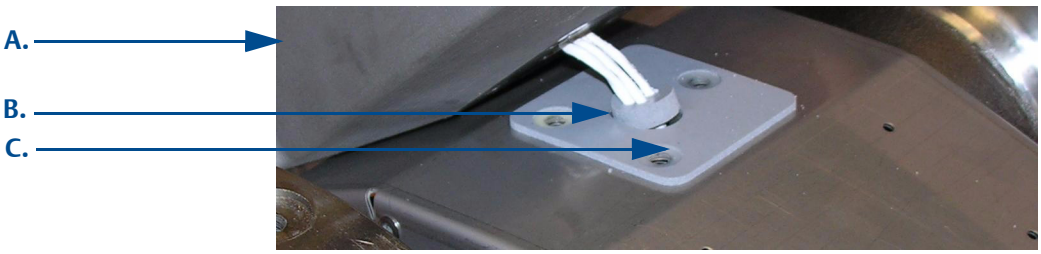
A. Feed-thru cable seal
B. Shoulder washer
C. Spring
D. Transducer capsule

Figure 3-15 LT-10 Transducer and cable assembly removed from meter



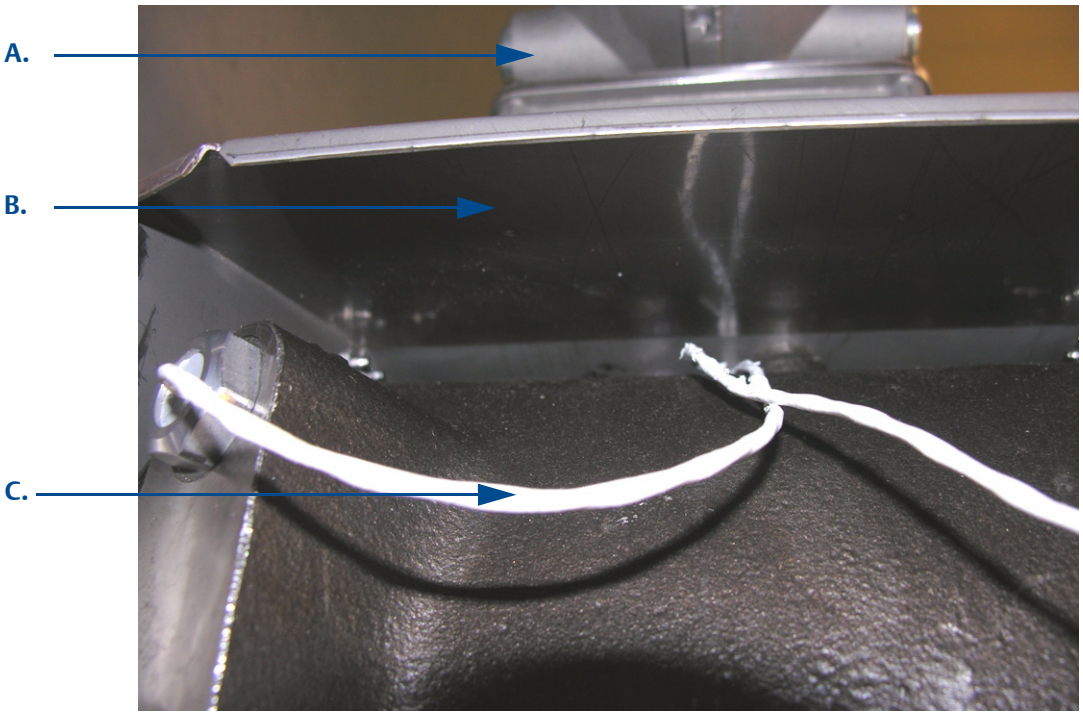
16. Pull the transducer cable from the meter (down through the foam Feed-thru cable seal on top of the meter body, the base cover gasket, nylon flat washers (Figure 3-16), and through the upper Shroud, Figure 3-17, of the meter. Repeat for each transducer you are removing.

Figure 3-16 Upper Shroud cable seal



A. Base Enclosure
B. Cable feed-thru seal
C. Base cover gasket and nylon flat washers

Figure 3-17 Cable removal from meter

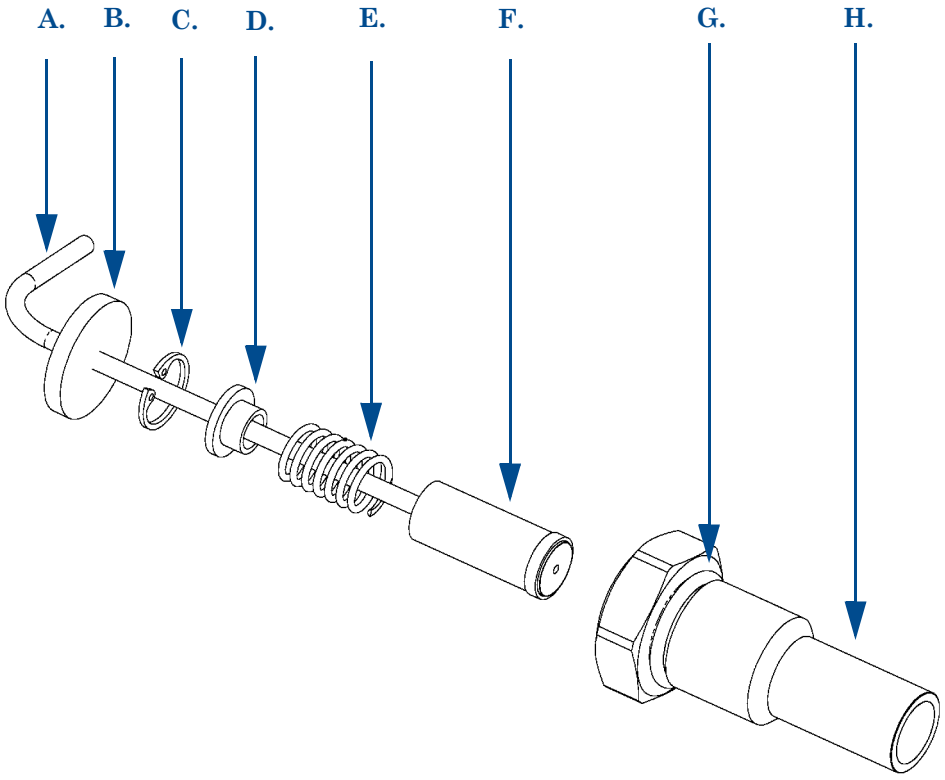


A. Transmitter Electronics Enclosure
B. Upper Shroud
C. Transducer cable

17. This completes the transducer removal procedure.

3.2.2 Transducer installation

Figure 3-18 LT-10 or LT-11transducer assembly



A. Transducer cable (P/N 1-504-90-129) (max. length 15 ft.)
B. Feed-thru cable seal (P/N 1-504-90-178)
C. Retaining ring (P/N 1-504-08-009)
D. Shoulder washer (P/N 1-504-90-181)
E. Spring (P/N 1-504-90-046)
F. Transducer capsule (1-360-01-624) or (LT-11 P/N 1-360-01-823)
G. O-ring (part numbers vary)
H. Transducer housing (P/N 1-360-01-632 for 316L SS or P/N 1-360-01-633 Inconel)

⚠WARNING

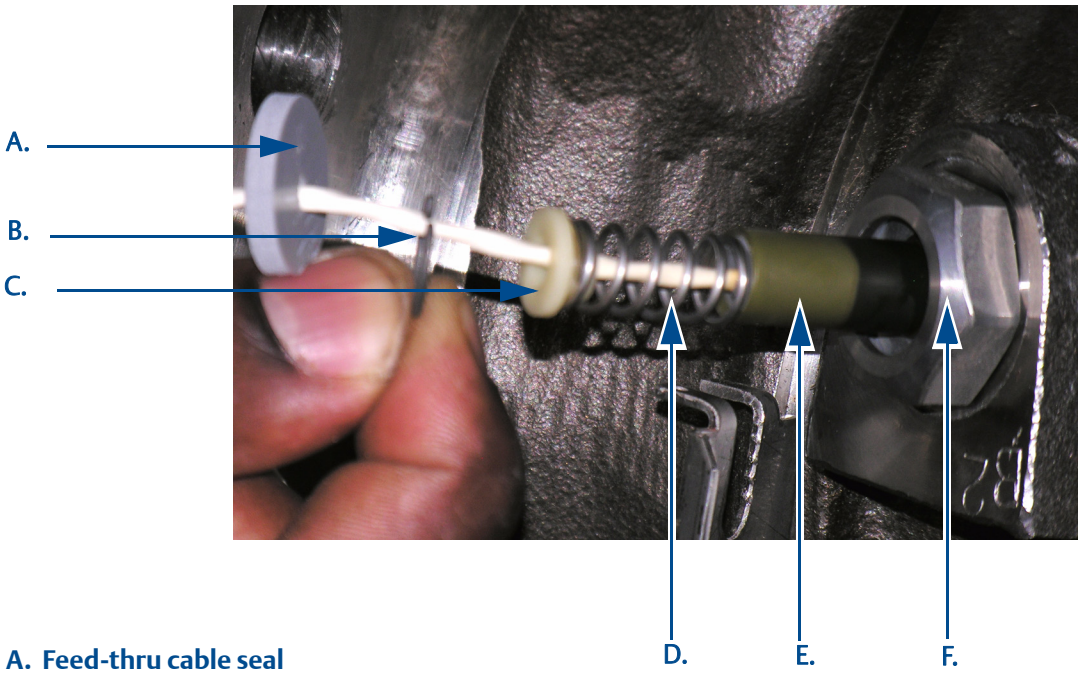
CUTTING HAZARD

Sharp edges may be present on the meter.

Wear appropriate personal protective equipment when working on the meter. Failure to do so may cause serious injury.

1. Place one drop of Dow Corning 200 Silicon Oil (12,500 Centistokes) (P/N 1-360-01-650) on the face of the transducer to be installed.
2. Insert the transducer capsule into the transducer housing inside the meter body.
3. Slide the spring, shoulder washer and retaining ring onto the transducer cable. Insert these components into the transducer housing.

Figure 3-19 Transducer, cable and components assembly

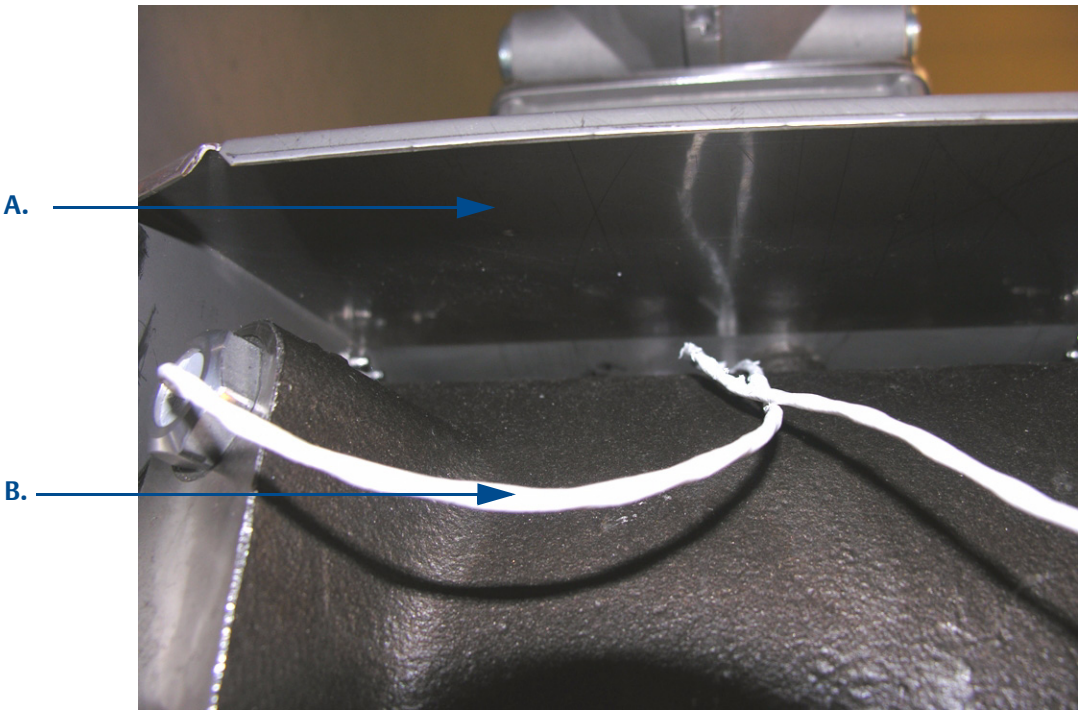


A. Feed-thru cable seal
B. Retaining ring
C. Shoulder washer
D. Spring
E. Transducer capsule
F. Transducer housing

4. Insert the Feed-thru cable seal into the housing groove with the Retaining Ring pliers.

5. Feed the transducer cable underneath the top Shroud to the top of the meter body.

Figure 3-20 Transducer cable installation



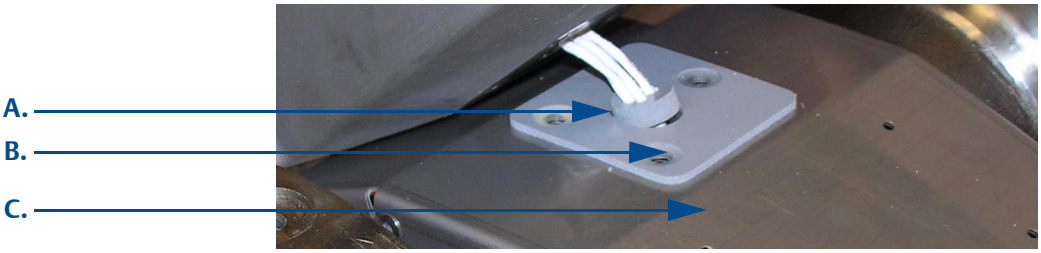
A. Upper Shroud
B. Transducer cable

6. Insert the transducer cable through the Base cover gasket and and flat washers into the Feed-thru foam cable seal. Feed the transducer cable into the Base Enclosure.

NOTICE

Feed-thru foam seals tear easily. Carefully pull the transducer cable through the seal to prevent ripping the Feed-thru cable seal.

Figure 3-21 Upper Shroud Feed-thru cables

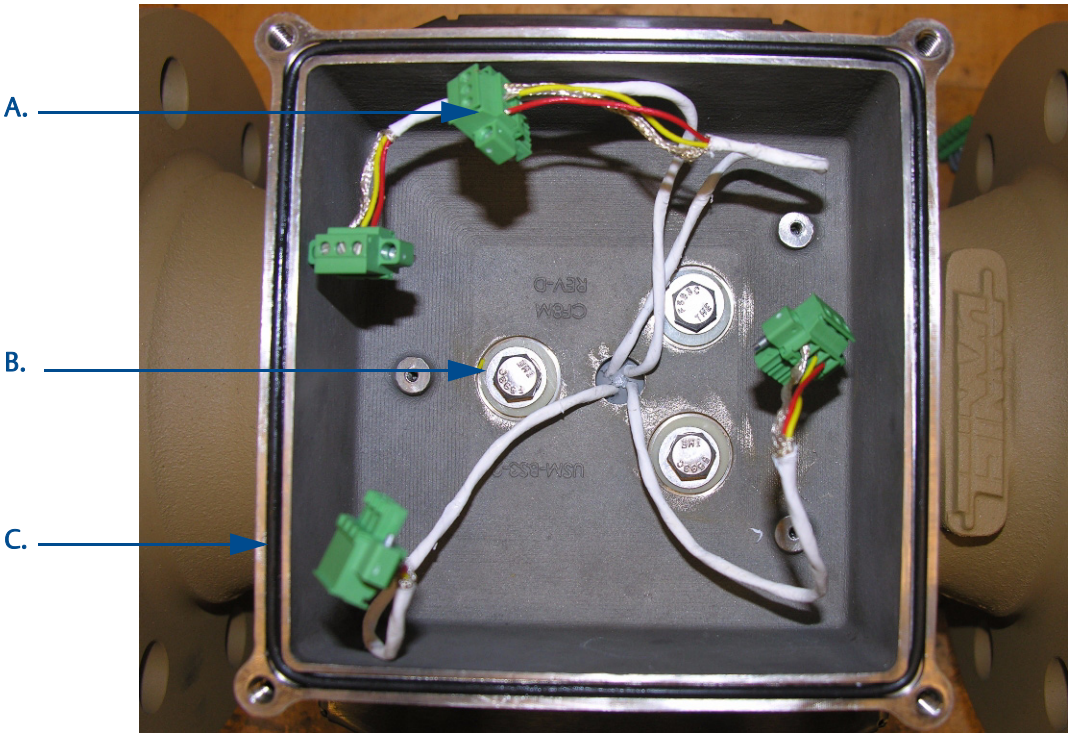


A. Cable Feed-thru seal
B. Base cover gasket and nylon flat washers
C. Upper shroud

7. Ensure the nylon flat washers are in place between the Base Enclosure and the Base Cover Gasket.
8. Repeat the Steps1- 5 above for each transducer assembly you are replacing.

9. Reattach the Base Enclosure to the meter body with the three shoulder washers, flat washers, split lock washers and hex head bolts. Tighten the bolts with a 7/16 inch (12mm) socket driver.

Figure 3-22 Base Enclosure installation



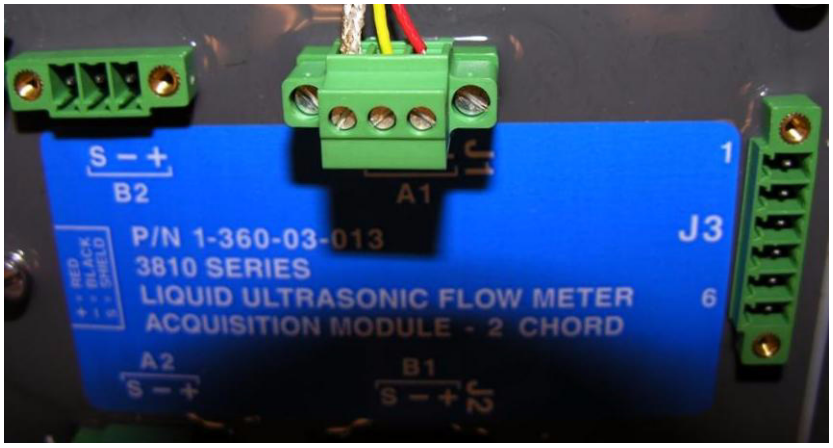
A. Transducer wiring terminal blocks
B. Hex hex bolts
C. Base Enclosure o-ring

10. Insert the Acquisition Module into the Base Enclosure and secure with the three split lock washers and flat head screws (see Figure 3-24). Position the cables to prevent pinching when the Acquisition Module is attached.

11. Cut the new transducer cable(s) to the correct length (maximum 15 feet) with allowance for the wiring terminations and connector placement. Strip back about 1.5 inches of the cable outer sheath and 1/4 inch of insulation from the wires. When stripping the outer sheath of the transducer cable, do not cut into the insulation of the individual wires.

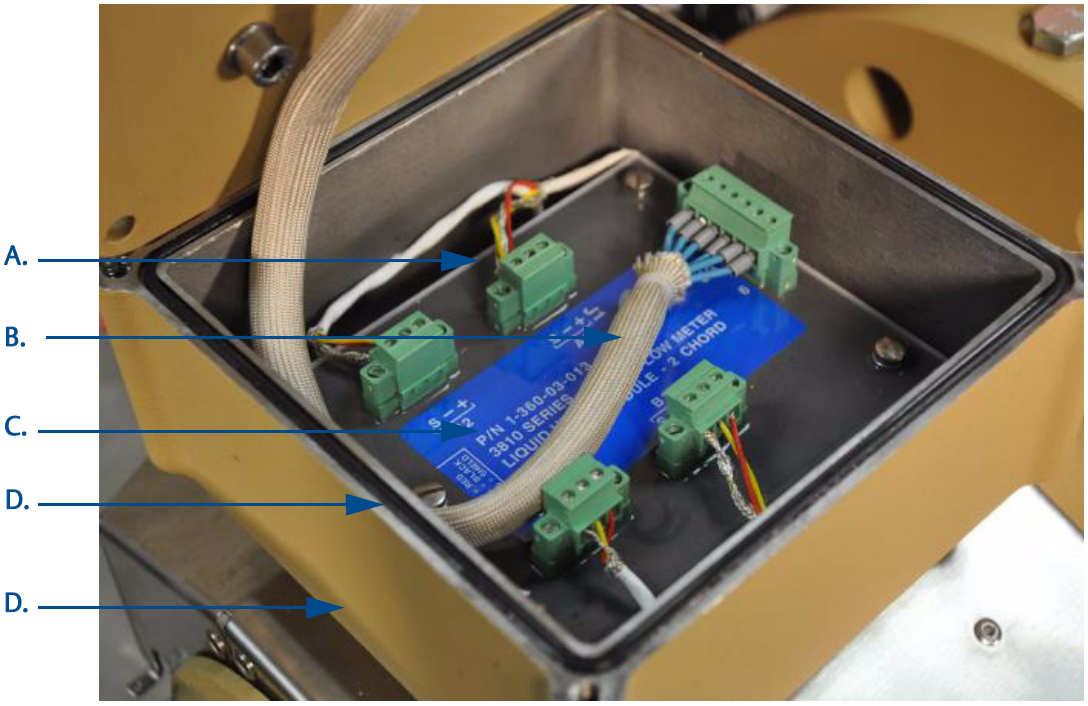
    The transducer cables have two wires and a bare drain wire that must be terminated on the applicable connector on the Acquisition Module. The red wire connects to the + (positive) pin, the black wire (yellow wire in Figure 3-23) connects to the - (negative) pin and the bare drain wire connects to the S-pin (Shield). Reattach the transducer cables to the terminal blocks with a 3mm flat blade screw driver and screw the terminal block onto the Acquisition Module for the corresponding chord (A1, B1, A2, or B2). Make sure the transducer wires have good contact with the terminal block and the terminal block screws are tight.

Figure 3-23 Transducer terminal block wiring



12. Plug the Acquisition cable terminal block into J3 on the Acquisition board and tighten the terminal block screws with a 1/8 inch (3mm) flat blade screw driver.

Figure 3-24 Transducer wiring and Acquisition cable reassembled

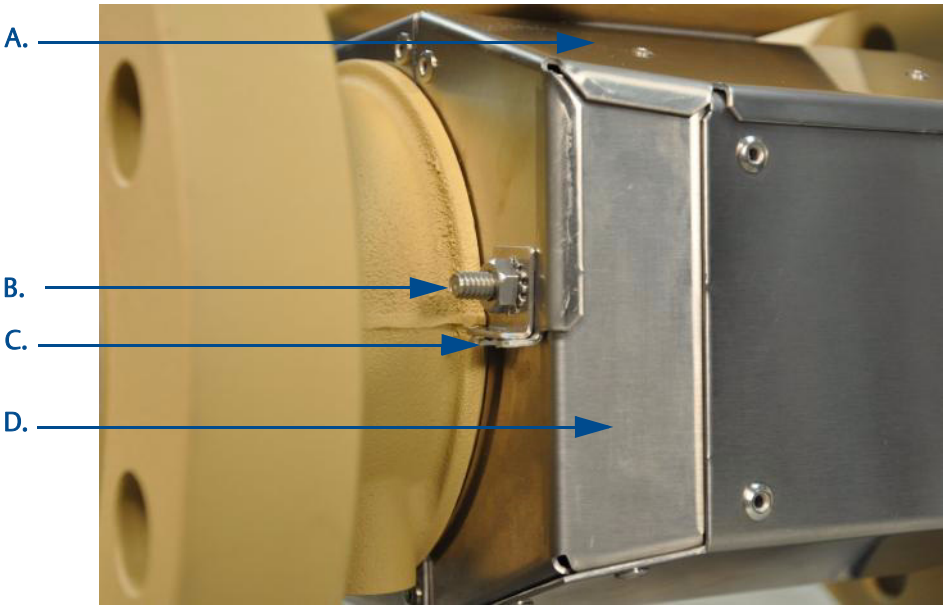


A. Transducer wiring terminal blocks
B. Acquisition cable
C. Acquisition Module
D. O-ring
E. Base Enclosure

13. Repeat these steps for other transducers you are replacing.
14. When you have completed wiring the transducer cables to the Acquisition Module, check the Base Enclosure o-ring and reinstall if necessary.
15. Reattach the Transmitter Electronics Enclosure to the Base Enclosure with the four hex head bolts and lock washers. Tighten bolts with a 7/16 inch (12mm) wrench.
16. Retighten or reattach the conduit to the Transmitter Electronics Enclosure using a crescent wrench or channel lock pliers.

17. Slide the lower Shroud beneath the meter body. Make sure the transducer cables are moved out of the way and will not be pinched when the Shroud is reinstalled.

Figure 3-25 Lower Shroud installation



A. Upper Shroud
B. Hex head nut with tooth lock washer
C. Shroud clamp and tab
D. Lower Shroud

18. Lift the lower Shroud until the bolts align with the upper Shroud tab and notches and the lower Shroud is flush with the top inside lip of the upper Shroud.
19. Install the four Shroud clamps onto the lower Shroud bolts and secure with the four hex head nuts and external tooth lock washers. Tighten the nuts with a 7/16 inch (12 mm) wrench.
20. Apply power to the meter and connect to Daniel MeterLink. Open the Meter Monitor (Detailed) view and verity the meter is acquiring data, the transducers have good signals and flow profiles for the chords are displayed.
21. In Daniel MeterLink, run the Zero Calibration utility to re-zero the meter at no-flow conditions.
22. Close your connection to Daniel MeterLink and prepare to seal the meter.
23. Attach the security wire seals on the Transmitter Enclosure end caps and through the hex head bolts on the Base Enclosure (see Figure 3-6) and then seal the Shroud (see Figure 3-10). Refer to the *Daniel 3812 Liquid Ultrasonic Meter Installation Manual* (P/N 3-9000-765, Section 3.6.8) for detailed sealing instructions.
24. This completes the transducer installation procedure.

3.3 Transducer housing removal and installation procedure

Daniel 3812 Liquid Ultrasonic Flow Meters utilize transducer housing s that contain the transducer capsules and act as the pressure barrier between the transducers and the fluid. Under normal maintenance such as transducer replacement, the transducer housing s do not need to be removed. If it is necessary to remove the transducer housings, the following steps detail how to safely remove and reinstall them.

The meter has integrally mounted transducer cables that require you to disconnect the cables from the terminal blocks inside the Base enclosure and remove the transducer capsule from the housing. This includes removing the Transmitter Electronics Enclosure, the Acquisition Module, the Base Enclosure and the Lower Shroud.

⚠WARNING

CUTTING HAZARD

Sharp edges may be present on the meter.

Wear appropriate personal protective equipment when working on the meter. Failure to do so may cause serious injury.

3.3.1 Transducer housing removal

⚠WARNING

FLUID CONTENTS MAY BE UNDER PRESSURE

When the meter is under pressure, DO NOT attempt to remove or adjust the transducer housing.

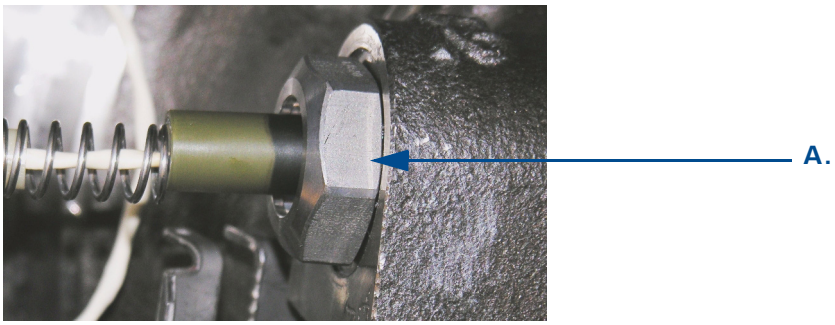
Attempting to do so may release pressurized fluid, resulting in serious injury or equipment damage.

⚠WARNING

FLUID CONTENTS MAY BE HAZARDOUS

The meter must be fully depressurized and drained before attempting to remove the transducer housing. If fluid begins to leak from the transducer housing, immediately reinstall it.

Failure to do so may cause serious injury or equipment damage.



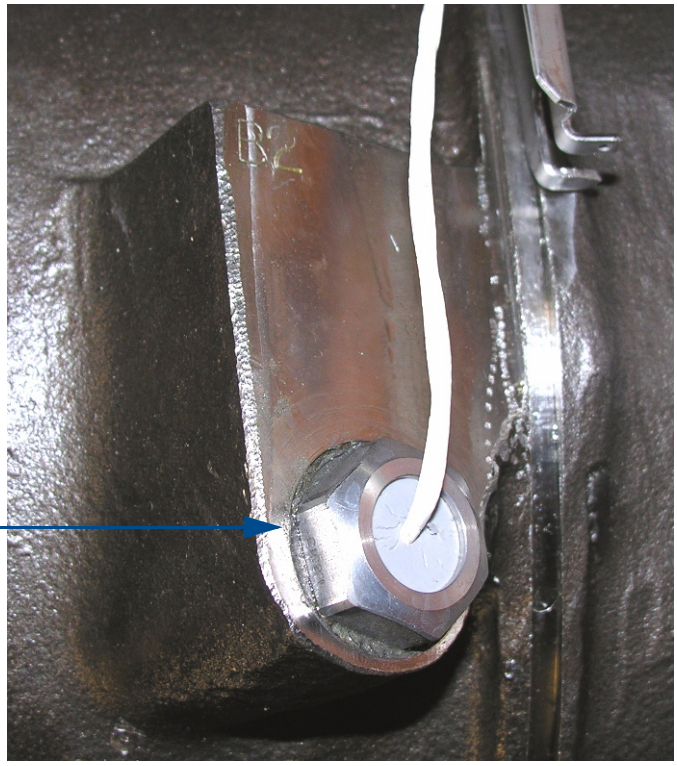
A. Transducer housing

1. Remove power from the meter.
2. Before removing the transducer housings, drain the meter of fluid and ensure the pressure inside the meter is at atmospheric pressure. **If fluid begins to leak from the meter or leaking from the threads, immediately stop and reinstall the housing as the meter has not been fully drained and/or pressure has not been relieved from the meter.**
3. If the installation has rigid conduit, use a medium size crescent wrench and loosen the hex nuts on the Transmitter Electronics Enclosure. This should allow enough slack to remove the Transmitter Electronics Enclosure from the Base Enclosure. If the installation uses flexible conduit, you may not need to disconnect it from the Transmitter Electronics Enclosure (see Figure 3-5).
4. Remove the Transmitter Electronics Enclosure end cap security seals the seals from the bolts on the Base Enclosure (see Figure 3-6).
5. Use a 7/16 inch(12mm) wrench and remove the four hex head bolts and split lock washers securing the Transmitter Electronics Enclosure to the Base Enclosure and remove the Transmitter Electronics Enclosure (see Figure 3-7).

6. Lift the Transmitter Electronics Enclosure off of the Base Enclosure to expose the Acquisition Module wiring. Prop the Transmitter Electronics Enclosure on top of the Base Enclosure and prepare to disconnect the Acquisition cable and transducer terminal blocks and disconnect the transducer wiring terminal blocks (see Figure 3-8).
7. Use a 1/8 inch (3mm) flat blade screw driver and disconnect the Acquisition cable terminal block and unplug the Acquisition cable terminal block.
8. Use a 3mm flat blade screw driver and disconnect the transducer wire terminal blocks from the Acquisition Module. Disconnect the transducer wires from the terminal blocks so that the cables can be removed from the meter.
9. Use a 1/4 inch (7mm) flat blade screw driver and remove the three Acquisition Module flat head screws, split lock washers, and flat washers then remove the Acquisition Module from the Base Enclosure (see Figure 3-8).
10. Use a 7/16 inch (12mm) socket wrench and remove the three Base Enclosure hex head bolts, shoulder washers, flat washers and split lock washers and then remove the Base Enclosure from the meter body (see Figure 3-9).
11. Remove the Shroud security seals (see Figure 3-10).
12. Use a 7/16 inch (12mm) wrench and remove the four Shroud hex nuts, external tooth lock washers and Shroud clamps. Then, slide the lower Shroud down to remove it from the meter body (see Figure 3-11).
13. Use Retaining Ring pliers (Daniel P/N 1-504-90-043or Stanley Proto #J371 or #371L) to pull the transducer cable Feed-thru foam seal from the transducer housing. Slide the Feed-thru seal down the cable (see Figure 3-13).
14. Use the Retaining Ring pliers and remove the retaining ring, shoulder washer, and spring from the transducer housing (see Figure 3-13).
15. Pull the transducer capsule from the housing.
16. Pull the transducer cable from the meter (down through the foam Feed-thru cable seal on top of the meter body, the base cover gasket, nylon flat washers (Figure 3-16), and through the upper Shroud (Figure 3-17) of the meter).
17. Repeat for each transducer capsule you are removing.

18. Place a wrench on the hex of the transducer housing and slowly unscrew in a counter-clockwise direction from the meter and remove it from the meter body.

Figure 3-26 Transducer housing removal



A. Transducer housing

19. This completes the transducer housing removal procedure.

3.3.2 Transducer housing Installation

⚠WARNING

CUTTING HAZARD

Sharp edges may be present on the meter.

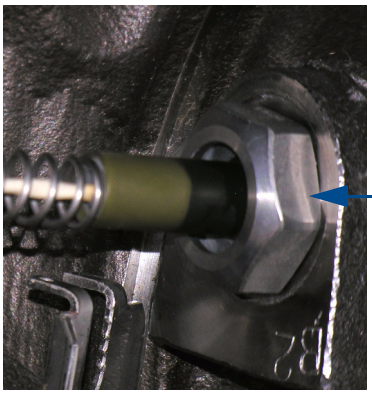
Wear appropriate personal protective equipment when working on the meter. Failure to do so may cause serious injury.

1. Any time a transducer housing is removed from the meter the o-rings must be replaced with new o-rings prior to reinstalling the housing in the meter. Apply a light coat of Dow Corning 111 Silicone grease or equivalent to the o-rings.

NOTICE

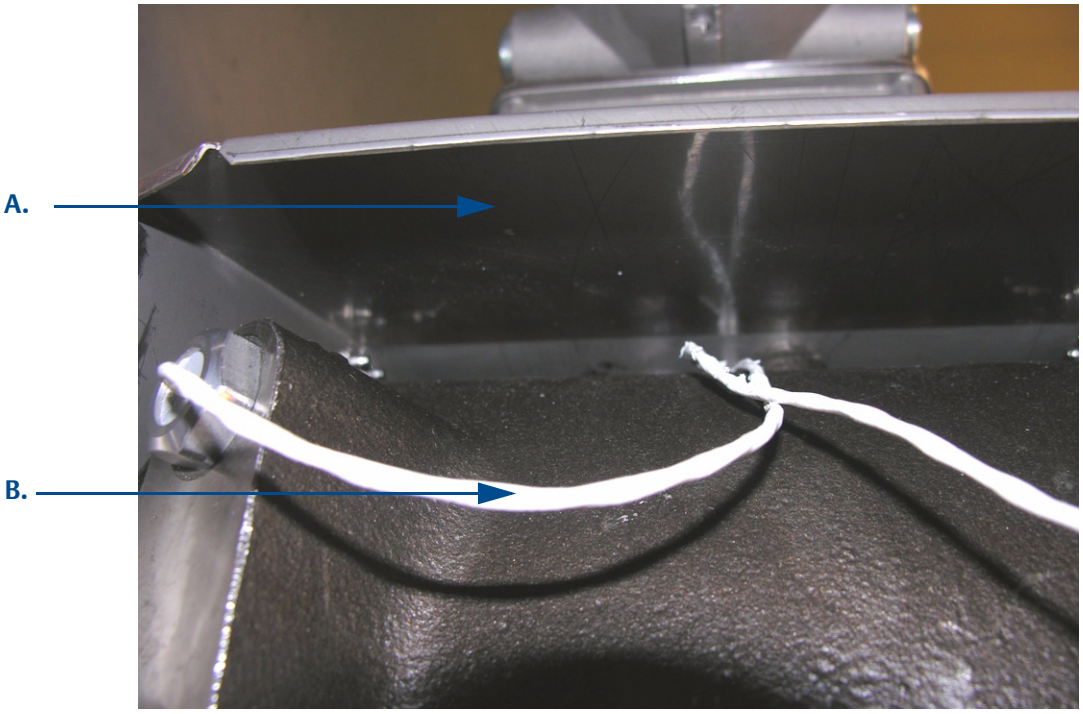
Replace with new O-rings during transducer maintenance or after every ten years of service.

2. Apply a light coat of Loctite® anti-seize nickel grade lubricant (20g stick-37230) on the transducer housing threads.
3. Ensure the transducer housing threads are properly aligned (avoid cross-threading the housing) with the meter body, then use a wrench on the hex bolt of the housing and slowly screw in a clockwise direction. Also, ensure the transducer housing is fully seated against the meter body per the table below (Refer to SAE J514 specification, Table 2A).

Transducer housing	Torque range Ft-lb (N-m)	Transducer housing
LT-10	40-43 (49-53)	
LT-11	90-99 (122-134)	

4. Place one drop of Dow Corning 200 Silicon Oil (12,500 Centistokes) (P/N 1-360-01-650) on the face of the transducer to be installed.
5. Insert the transducer capsule into the transducer housing inside the meter body (see Figure 3-19).
6. Slide the spring, shoulder washer and retaining ring onto the transducer cable. Insert these components into the transducer housing. Insert the Feed-thru cable seal into the housing groove with the Retaining Ring pliers.
7. Feed the transducer cable underneath the top Shroud to the top of the meter body.

Figure 3-27 Transducer installation



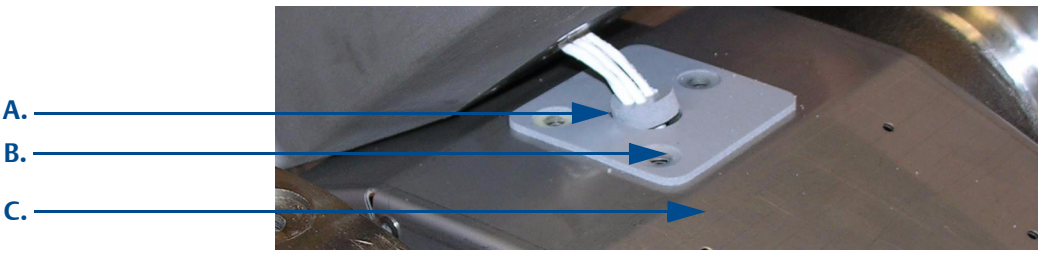
A. Upper Shroud
B. Transducer cable

8. Insert the transducer cable through the Base cover gasket and flat washers into the Feed-thru foam cable seal. Feed the transducer cable into the Base Enclosure (see Figure 3-16).

NOTICE

Feed-thru foam seals tear easily. Carefully pull the transducer cable through the seal to prevent ripping the Feed-thru cable seal.

Figure 3-28 Upper Shroud Feed-thru cable seal



A. Cable Feed-thru seal
B. Base cover gasket and nylon flat washers
C. Upper shroud

9. Ensure the nylon flat washers are in place between the Base Enclosure and the Base Cover Gasket.
10. Repeat for each transducer housing and transducer assembly you replaced.

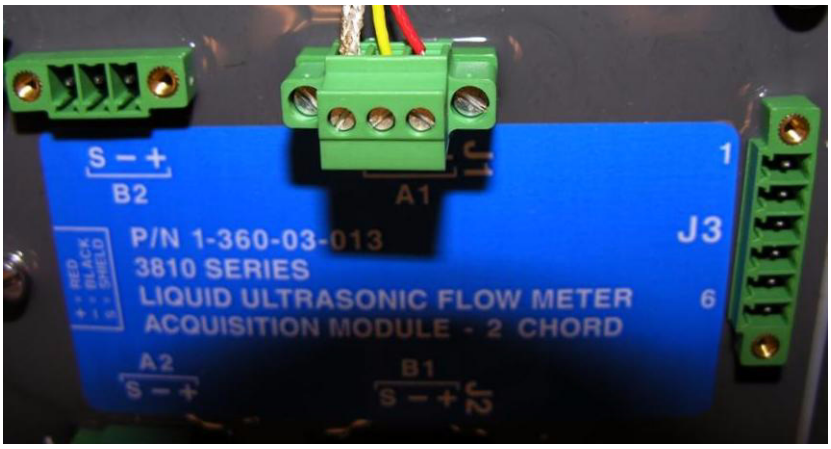
11. Reattach the Base Enclosure to the meter body with the three shoulder washers, flat washers, split lock washers and hex head bolts. Tighten the bolts with a 7/16 inch (12mm) socket driver (see Figure 3-22).

12. Insert the Acquisition Module into the Base Enclosure and secure with the three split lock washers and flat head screws (see Figure 3-24). Position the cables to prevent pinching when the Acquisition Module is attached.

13. Cut the new transducer cable(s) to the correct length (maximum 15 feet) with allowance for the wiring terminations and connector placement. Strip back about 1.5 inches of the cable outer sheath and 1/4 inch of insulation from the wires. When stripping the outer sheath of the transducer cable, do not cut into the insulation of the individual wires.

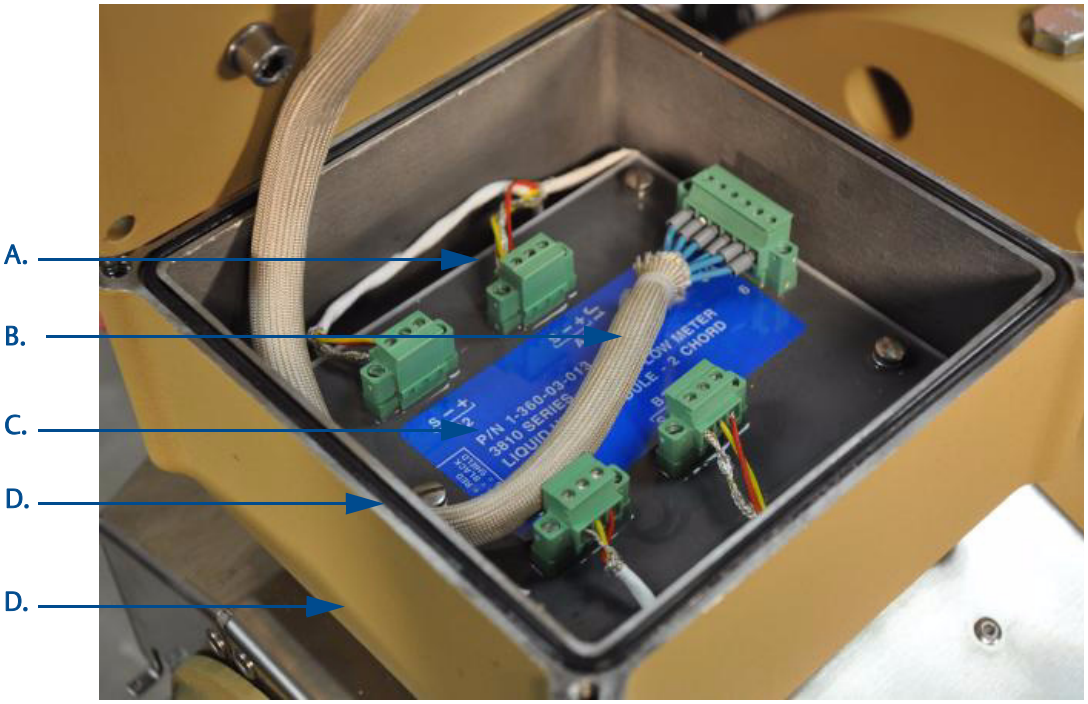
    The transducer cables have two wires and a bare drain wire that must be terminated on the applicable connector on the Acquisition Module. The red wire connects to the + (positive) pin, the black wire (yellow wire in Figure 3-23) connects to the - (negative) pin and the bare drain wire connects to the S-pin (Shield). Reattach the transducer cables to the terminal blocks with a 1/8 inch(3mm) flat blade screw driver and screw the terminal block onto the Acquisition Module for the corresponding chord (A1, B1, A2, or B2). Make sure the transducer wires have good contact with the terminal block and the terminal block screws are tight.

Figure 3-29 Transducer terminal block wiring



14. Plug the Acquisition cable terminal block into J3 on the Acquisition board and tighten the terminal block screws with a 1/8 inch (3mm) flat blade screw driver.

Figure 3-30 Transducer wiring and Acquisition cable reassembled

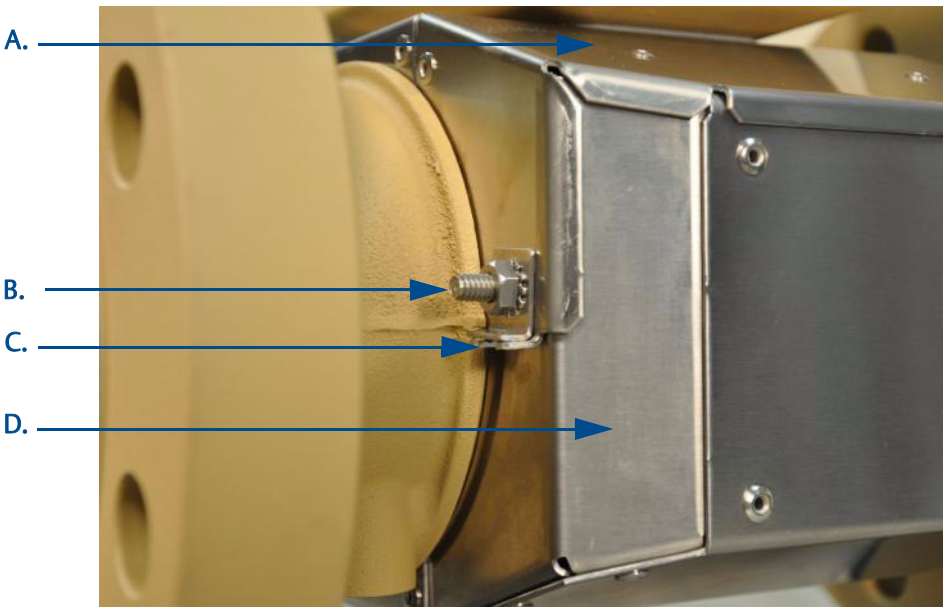


A. Transducer wiring terminal blocks
B. Acquisition cable
C. Acquisition Module
D. O-ring
E. Base Enclosure

15. Repeat these steps for other transducers you are replacing.
16. When you have completed wiring the transducer cables to the Acquisition Module, check the Base Enclosure o-ring and reinstall if necessary.
17. Reattach the Transmitter Electronics Enclosure to the Base Enclosure with the four hex head bolts and lock washers. Tighten bolts with a 7/16 inch (12mm)wrench.
18. Retighten or reattach the conduit to the Transmitter Electronics Enclosure using a crescent wrench or channel lock pliers.

19. Slide the lower Shroud beneath the meter body. Make sure the transducer cables are moved out of the way and will not be pinched when the Shroud is reinstalled.

Figure 3-31 Lower Shroud installation



A. Upper Shroud
B. Hex head nut with tooth lock washer
C. Shroud clamp and tab
D. Lower Shroud

20. Lift the lower Shroud until the bolts align with the upper Shroud tab and notches and the lower Shroud is flush with the top inside lip of the upper Shroud.

21. Install the four Shroud clamps onto the lower Shroud bolts and secure with the four hex head nuts and external tooth lock washers. Tighten the nuts with a 7/16 inch (12mm) wrench.

22. Apply power to the meter and connect to Daniel MeterLink. Open the detailed view in Meter Monitor and verity the meter is acquiring data, the transducers have good signals and flow profiles for the chords are displayed.

23. Use the **Tools>Transducer Swap-out** menu path to access the Transducer Swap-out Wizard. The Transducer Swap-Out Wizard is a utility that allows you to easily update parameters such as path lengths, delay times, and delta times for chord. This is necessary anytime transducers and transducer housing s have to be replaced for a chord. The wizard guides you through updating which chords have been changed, which components in the chords have been changed, as well as recalculating new path lengths based on the information entered. This utility is only available while connected to a meter.

24. Disconnect communications with the meter and close Daniel MeterLink.

25. This completes the installation of the transducer housing, transducer capsule, and transducer cables.

3.4 Replace the meter electronics

The following procedure should be performed by a qualified service technician or trained personnel. **Observe all warning labels on the meter before starting this procedure.**

The Transmitter Electronics Enclosure consists of the following:

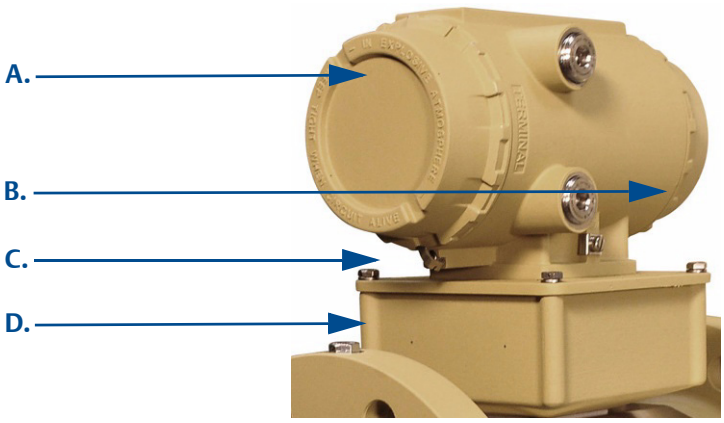
- CPU Module assembly (P/N 1-360-03-014)
- Optional I/O Module (Future)
- I.S. Barrier Board (P/N 1-360-03-004)
- Power Supply (P/N 1-360-03-003)
- Backplane Board (P/N 1-360-03-07)

The Base Enclosure consists of the following:

- Acquisition Module (P/N 1-360-03-013)
- Acquisition Cable (P/N 1-360-01-595)

Should the meter require disassembly in the field (i.e., check boards, change switch settings, or replace boards), to prevent electrostatic damage to the electronic boards, always use a Ground Strap while handling the circuit boards. If one is not available, make sure you are electrically discharged before touching the boards by first touching a metal surface such as a ground lug on the meter body, piping or metal structure.

Figure 3-32 3810 Series electronics

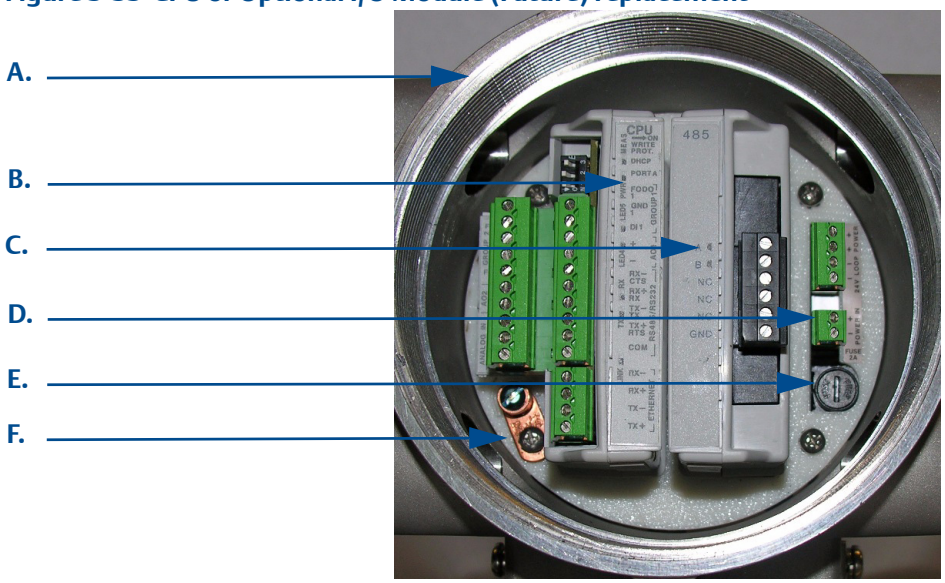


A. Terminal end of Transmitter Electronics Enclosure
B. Backplane board location
C. End cap security latch
D. Base enclosure with Acquisition Module

3.4.1 Replace CPU Module or Optional I/O Module (Future)

1. Remove power to the meter.
2. Refer to Figure 3-4 for the tools required to complete this procedure.
3. Disconnect security seals on the Transmitter Electronics Enclosure (see Figure 3-6), loosen the end cap security latches using a 3 mm Allen wrench (see Figure 3-7) and remove both end caps from the Transmitter Electronics Enclosure.
4. If replacing the CPU Module (terminal end of the enclosure) or the Optional I/O Module (Future), use a 3mm flat blade screw driver and disconnect the CPU Module terminal blocks (or the Optional I/O Module (Future) terminal blocks).

Figure 3-33 CPU or Optional I/O Module (Future) replacement

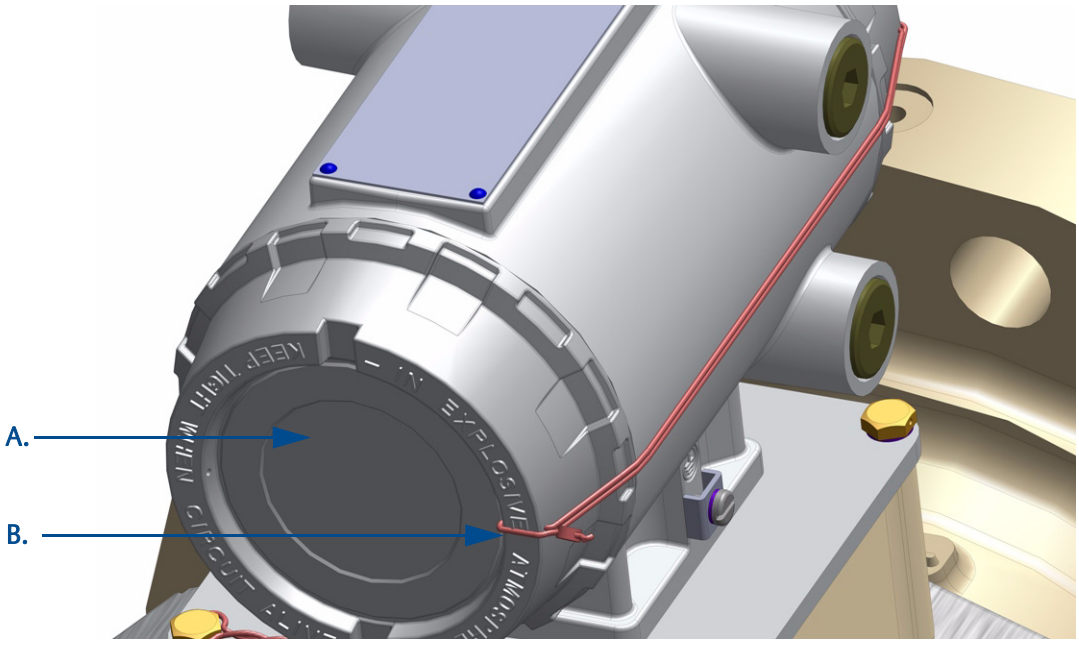


A. Terminal end of Transmitter Electronics Enclosure
B. CPU Module
C. Optional I/O Module (Future)
D. Power Supply board
E. Fuse
F. Internal chassis ground

5. Grasp the module you want to replace and pull it out of the enclosure.
6. Insert the new CPU Module or I/O Module into the enclosure and firmly push until the board is fully seated into the Backplane Board connectors.
7. Replace the terminal blocks for the CPU Module and/or the Optional I/O Module and tighten the flat head screws with a 3mm flat blade screw driver.

8. If you are not replacing other electronics, replace the end caps and security latches (requires a 3 mm Allen wrench). If required, install the security seal wire into and through one of the two holes in the end cap. Choose holes that minimize counterclockwise rotation of the end cap when the security wire is taut (maximum wire diameter.078 inch; 2.0mm).

Figure 3-34 Transmitter electronic enclosure security seals



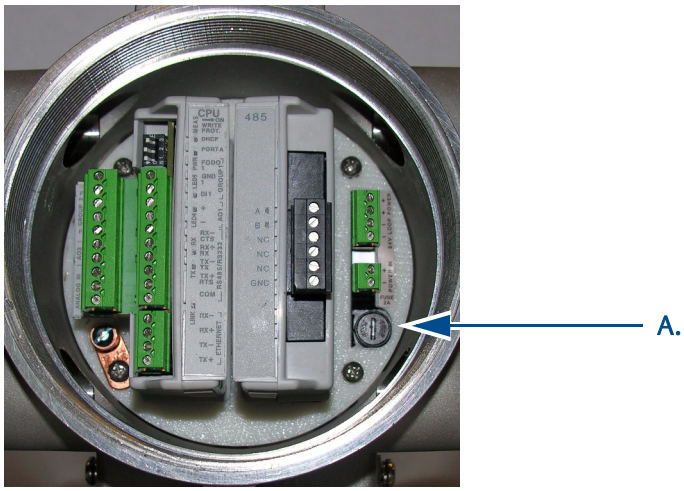
A. Transmitter Electronics Enclosure end cap
B. Security wire seals

9. Adjust the security wire, removing all slack and thread into the lead seal.
10. Cut wire ends to remove excess wire.
11. If replacing other electronics or the fuse, continue with Section 3.4.2, Section 3.4.3 and Section 3.4.4 before replacing the end caps and sealing the enclosure.
12. If you encounter problems replacing the electronics, see the Daniel Customer Service contact information on the back cover of this manual.
13. This completes the CPU Module or I/O Module replacement procedure.

3.4.2 Fuse Replacement

1. Remove power to the meter.
2. Refer to Figure 3-4 for the tools required to complete this procedure.
3. Disconnect the Transmitter Electronics Enclosure security seals (see Figure 3-34), loosen the end cap security latch (requires a 3 mm Allen wrench) on the terminal end of the enclosure (see Figure 3-32) and remove the end cap.
4. Use a 1/4 inch (7mm) standard flat head screw driver and remove the Fuse holder cap (see Figure 3-33).

Figure 3-35 Fuse holder cap



A. Fuse holder cap

5. Remove the fuse from the holder.
6. Insert the replacement fuse (Littlefuse #218002.HXP) into the Fuse holder.
7. Install the fuse cap into the holder and push until it is flush with the holder.
8. Turn the fuse cap clockwise 1/8 turn using a 1/4 inch standard flat head screw driver.
9. If replacing other electronics, continue with Section 3.4.3, and Section 3.4.4 before replacing the end caps and sealing the enclosure.
10. If you are not replacing other electronics, replace the end caps and security latches (requires a 3 mm Allen wrench). Install the security seal wire into and through one of the two holes in the end cap. Choose holes that minimize counterclockwise rotation of the end cap when the security wire is taut (maximum wire diameter.078 inch; 2.0mm) (see Figure 3-34).
11. Adjust the security wire, removing all slack and thread into the lead seal.
12. Cut wire ends to remove excess wire.
13. Apply power to the meter.
14. This completes the fuse replacement procedure.

3.4.3 Replace Backplane, I.S. Barrier or Power Supply board

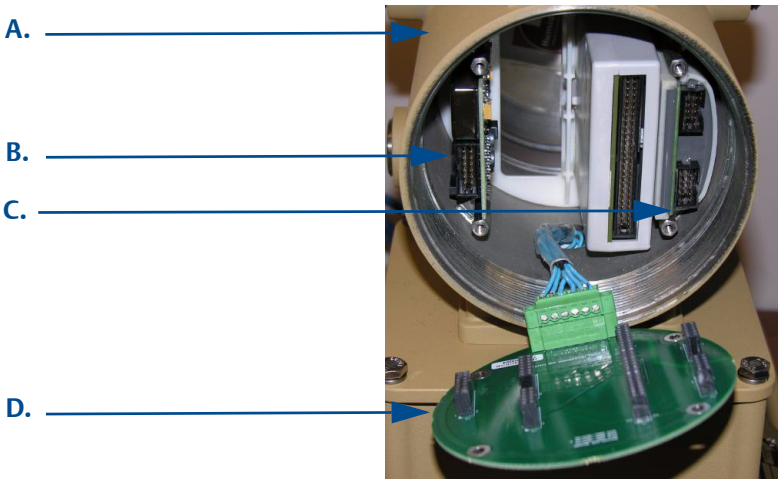
The following sections detail removal of the Backplane board, the I.S. Barrier Board and the Power Supply Board.

Backplane replacement

1. If replacing the Backplane board, remove power to the meter.
2. Refer to Figure 3-4 for the tools required to complete this procedure.
3. Disconnect the Transmitter Electronics Enclosure security seals (see Figure 3-34), loosen the end cap security latches (3mm Allen wrench required, see Figure 3-32) and remove both end caps.
4. Remove the CPU Module and the Optional I/O Module (Future). See Figure 3-33 for board locations and associated terminal blocks.
5. Use a Phillips head screw driver and remove the four Backplane board screws and captive star washers from the enclosure standoffs.

6. Pull the Backplane board out of the enclosure. This disconnects the I.S. Barrier Board. Lay the Backplane board down with the Acquisition Cable still attached (the Power Supply board may remain attached to the Backplane when you remove it from the enclosure).

Figure 3-36 Backplane board replacement



A. Non-terminal end of Transmitter Electronics Enclosure
B. Power Supply board
C. I.S. Barrier board (inside the Guide Plate)
D. Backplane board

7. Use a 1/8 inch (3 mm) flat head screw driver and disconnect the Acquisition Cable terminal block from the Backplane. Unplug the Acquisition Cable from the Backplane.
8. Remove the Power Supply (if it was not removed with the Backplane board) and I.S. Barrier boards from the enclosure. The I.S. Barrier Board has a notched tab that secures the board to the Guide Plate.
9. Attach the Acquisition Cable terminal block to the new Backplane Board and plug the Power Supply Board and I.S. Barrier board into the Backplane board.
10. Insert the Backplane (with the Power Supply and I.S. Barrier Boards attached to the Backplane) into the enclosure.
11. Fully seat the CPU Module and Optional I/O Module onto the Backplane board.
12. Install the four Phillips head screws to secure the Backplane to the enclosure standoffs.
13. Reinstall the terminal blocks on the CPU Module, Optional I/O Module (Future), and the Power Supply board using a 3 mm flat head screw driver.

NOTICE

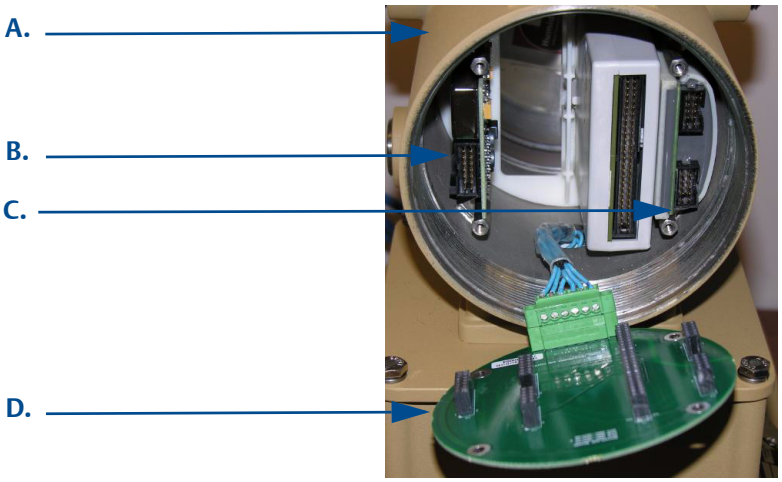
Make sure the terminal blocks are aligned with the Guide Plate openings.

14. Recheck the connections, wiring and switch settings before replacing the end caps.
15. If replacing other electronics, continue with the following sections before replacing the end caps and sealing the enclosure.
16. If you are not replacing other electronics, replace the end caps, security latches, reseal the meter and apply power. Install the security seal wire into and through one of the two holes in the end cap. Choose holes that minimize counterclockwise rotation of the end cap when the security wire is taut (maximum wire diameter.078 inch; 2.0mm) (see Figure 3-34.
17. Adjust the security wire, removing all slack and thread into the lead seal.
18. Cut wire ends to remove excess wire.
19. Apply power to the meter.
20. This completes the Backplane Board replacement procedure.
21. If you encounter problems with this procedure, see the Daniel Customer Service contact information on the back cover of this manual.

I.S. Barrier Board replacement

1. If replacing the I.S. Barrier board, remove power to the meter.
2. Refer to Figure 3-4 for the tools required to complete this procedure.
3. Disconnect the Transmitter Electronics Enclosure security seals, loosen the end cap security latches with a 3mm Allen wrench and remove both end caps (see Figure 3-32).
4. Use a 1/8 inch (3 mm) flat head screw driver and remove the terminal blocks from the Power Supply board, the CPU Module and the Optional I/O Module (Future). See Figure 3-33 for board locations and associated terminal blocks.
5. Use a Phillips head screw driver and remove the four Backplane board screws from the enclosure standoffs.
6. Pull the Backplane board out of the enclosure. This disconnects the I.S. Barrier Board. Lay the Backplane board down with the Acquisition Cable still attached (the Power Supply board may remain attached to the Backplane when you remove it from the enclosure).

Figure 3-37 I.S. Barrier board replacement

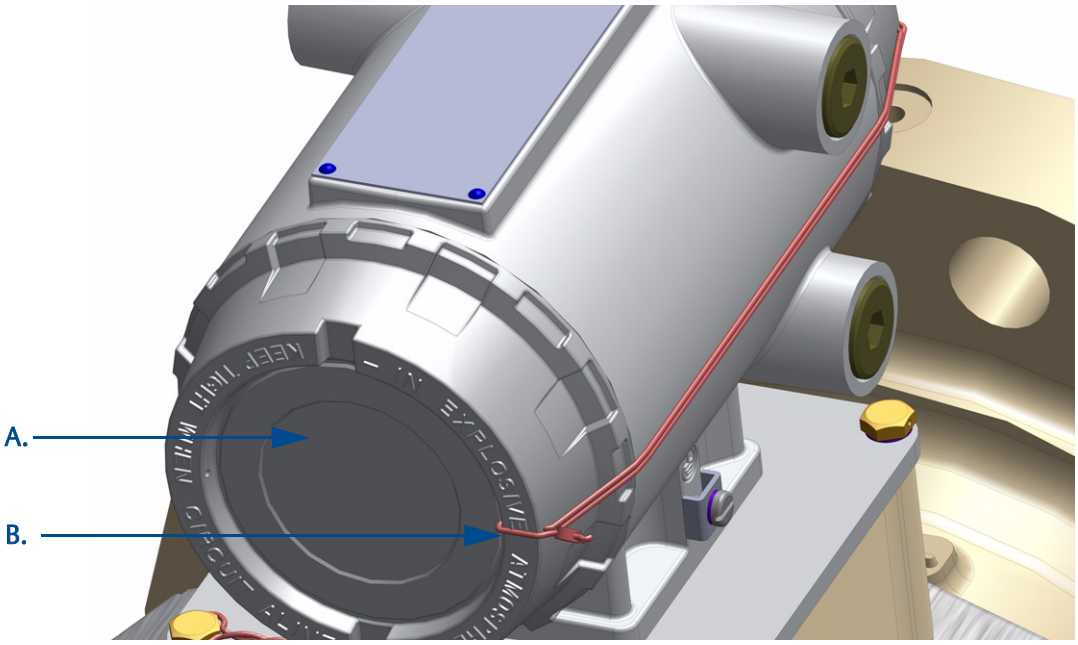


A. Non-terminal end of Transmitter Electronics Enclosure
B. Power Supply board
C. I.S. Barrier board (inside the Guide Plate)
D. Backplane board

7. Remove the I.S. Barrier Board from the Guide Plate on the right side of the enclosure.
8. Install the new I.S. Barrier board onto the Backplane Board and seat the Power Supply board onto the Backplane board.
9. Insert the Backplane, I.S. Barrier board and the Power Supply Board into the enclosure
10. Fully seat the CPU Module and Optional I/O Module (Future) onto the Backplane Board.

11. Attach the Backplane to the enclosure standoffs with the four Phillips head screws.
12. Reinstall the terminal blocks1/8 inch (3 mm) flat head screw driver on the CPU Module, Optional I/O Module (Future), I.S. Barrier Board and the Power Supply.
13. Recheck the connections, wiring and switch settings before replacing the end caps.
14. If replacing other electronics, continue with the following procedures before replacing the end caps and sealing the enclosure.
15. If you are not replacing other electronics, replace the end caps and security latches (3 mm Allen wrench required). Install the security seal wire into and through one of the two holes in the end cap. Choose holes that minimize counterclockwise rotation of the end cap when the security wire is taut (maximum wire diameter.078 inch; 2.0mm).

Figure 3-38 Transmitter electronic enclosure security seals



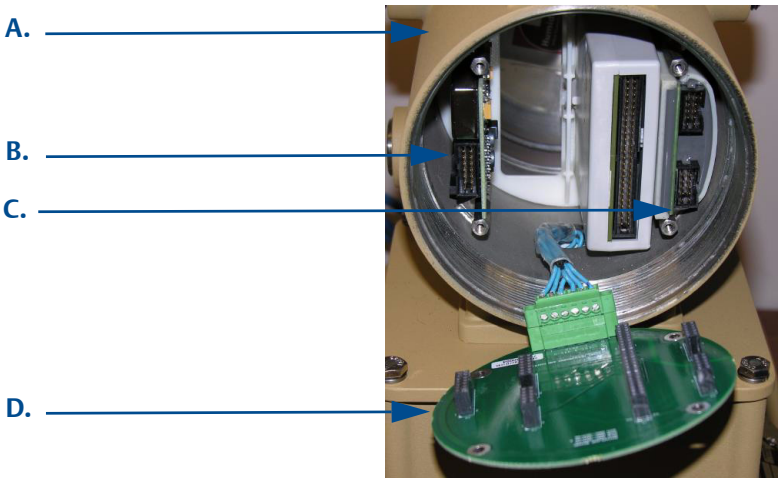
A. Transmitter Electronics Enclosure end cap
B. Security wire seals

16. Adjust the security wire, removing all slack and thread into the lead seal.
17. Cut wire ends to remove excess wire.
18. Apply power to the meter.
19. This completes the I.S. Barrier Board replacement procedure.
20. If you encounter problems with this procedure, see the Daniel Customer Service contact information on the back cover of this manual.

Power Supply Board replacement

1. If replacing the Power Supply board remove power to the meter.
2. Refer to Figure 3-4 for the tools required to complete this procedure.
3. Disconnect the Transmitter Electronics Enclosure security seals, loosen the end cap security latches with a 3mm Allen wrench and remove both end caps (see Figure 3-38).
4. Use a 1/8 inch (3 mm) flat head screw driver and remove the terminal blocks from the Power Supply board, the CPU Module and the Optional I/O Module (Future). See Figure 3-33 for board locations and associated terminal blocks.
5. Use a #1Standard Phillips head screw driver and remove the four Backplane board screws from the enclosure standoffs.

Figure 3-39 Power Supply board replacement



A. Non-terminal end of Transmitter Electronics Enclosure
B. Power Supply board
C. I.S. Barrier board (inside the Guide Plate)
D. Backplane board

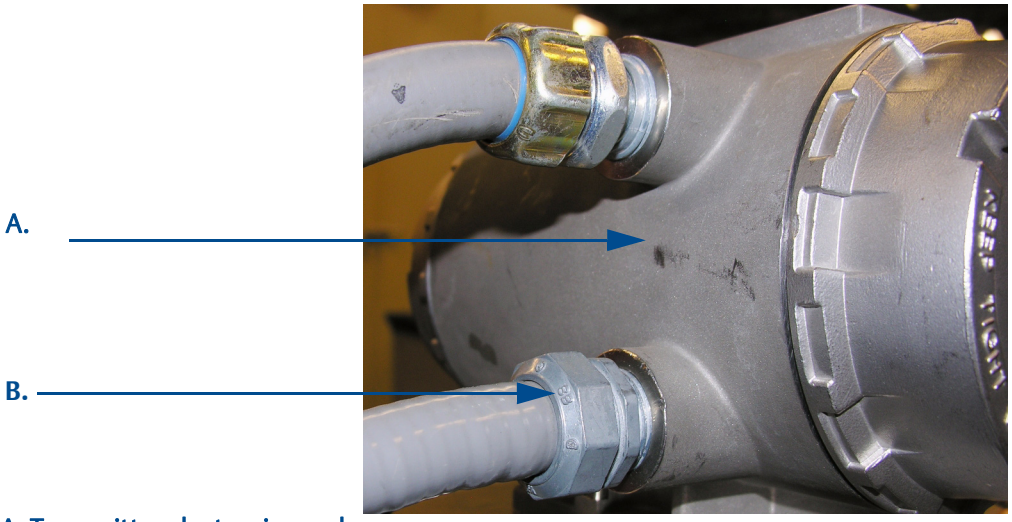
6. Pull the Backplane board out of the enclosure. This disconnects the I.S. Barrier Board. Lay the Backplane board down with the Acquisition Cable still attached (the Power Supply board may remain attached to the Backplane when you remove it from the enclosure).
7. Plug the new Power Supply board and the I.S. Barrier Board onto the Backplane Board.
8. Insert the Backplane, I.S. Barrier board and the Power Supply Board into the enclosure and fully seat the CPU Module and Optional I/O Module (Future).
9. Attach the Backplane to the enclosure standoffs with the four Phillips head screws.
10. Use a 1/8 inch (3 mm) flat blade screw driver and install the terminal blocks on the CPU Module, Optional I/O Module (Future), I.S. Barrier Board and the Power Supply.
11. Recheck the connections, wiring and switch settings before replacing the end caps.
12. If replacing other electronics, continue with Section 3.4.4 before replacing the end caps and sealing the enclosure.

13. If you are not replacing other electronics, replace the Transmitter Electronics Enclosure end caps, install the end cap security latches (3mm Allen wrench required). Install the security seal wire into and through one of the two holes in the end cap. Choose holes that minimize counterclockwise rotation of the end cap when the security wire is taut (maximum wire diameter.078 inch; 2.0mm) (see Figure 3-38).
14. Apply power to the meter.
15. This completes the Power Supply Board replacement procedure.
16. If you encounter problems with this procedure, see the Daniel Customer Service contact information on the back cover of this manual.

3.4.4 Acquisition Module replacement

1. Remove power to the meter.
2. Refer to Figure 3-4 for the tools required to complete this procedure.
3. If the installation has rigid conduit, use a medium size crescent wrench and loosen the hex nuts on the Transmitter Electronics Enclosure. This should allow enough slack to remove the Transmitter Electronics Enclosure from the Base Enclosure. If the installation uses flexible conduit, you may not need to disconnect it from the Transmitter Electronics Enclosure.

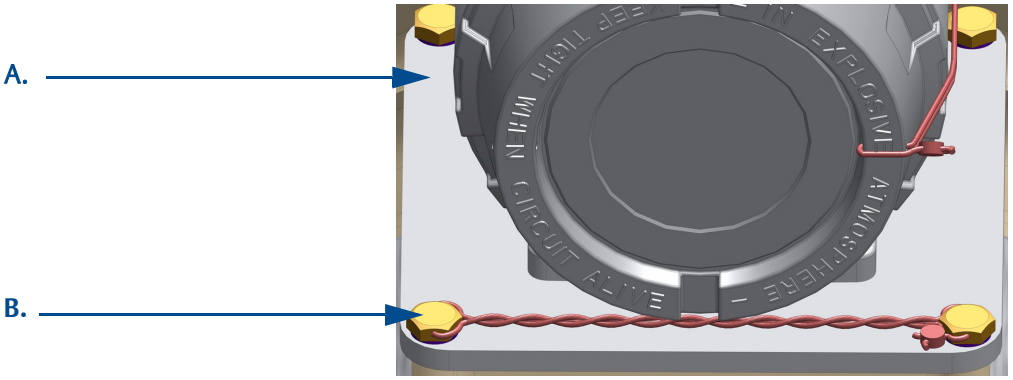
Figure 3-40 Conduit removal



A. Transmitter electronics enclosure
B. Conduit bolts

4. If the meter is equipped with security seals, remove the seals from the bolts on the Base Enclosure.

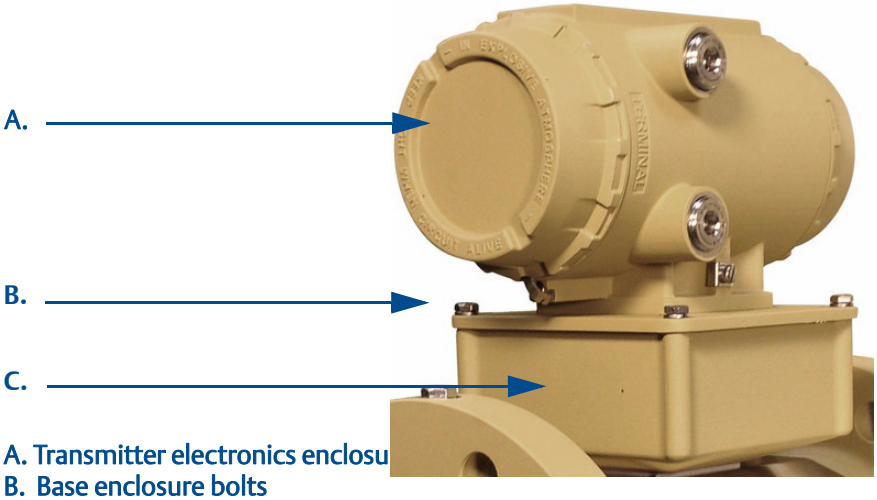
Figure 3-41 Transmitter Electronics Enclosure and Base Enclosure security seal removal



A. Transmitter electronics enclosure
B. Base enclosure bolts and security seals

5. Use a 7/16 inch (12mm) wrench and remove the four hex head bolts and split lock washers securing the Transmitter Electronics Enclosure to the Base Enclosure.

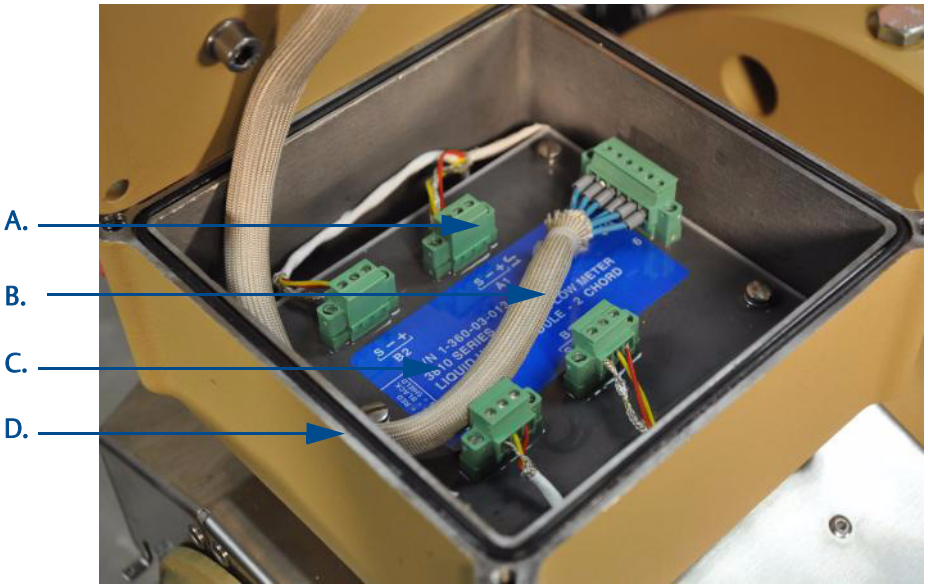
Figure 3-42 Transmitter Electronics Enclosure removal



A. Transmitter electronics enclosu
B. Base enclosure bolts
C. Base enclosure

6. Use a 1/8 inch (3 mm) flat head screw driver and disconnect the Acquisition cable terminal block and the transducer wire terminal blocks from the Acquisition Module inside of the Base enclosure.

Figure 3-43 Acquisition Module cable and transducer wiring



A. Transducer wiring terminal blocks
B. Acquisition cable
C. Acquisition Module
D. Base Enclosure o-ring

NOTICE

Make sure the transducer cables are labeled for the chord configuration (A1, A2, B1 and B2).

7. Remove the three Acquisition Module flat head screws and split lock washers, then remove the Acquisition Module from the Base Enclosure.
8. Insert the new Acquisition Module into the Base Enclosure and secure with the three split lock washers and flat head screws.
9. Reattach the terminal blocks onto the Acquisition Module 1/8 inch (3 mm) flat head screw driver for the corresponding chord (A1, B1, A2, or B2). Make sure the transducer wires have good contact with the terminal block and the terminal block screws are tight.

10. When you have completed attaching the terminal blocks to the Acquisition Module, check the Base Enclosure o-ring and reinstall if necessary.
11. Reattach the Transmitter Electronics Enclosure to the Base Enclosure with the four hex head bolts and lock washers. Tighten bolts with a 7/16 inch wrench.
12. Retighten or reattach the conduit to the Transmitter Electronics Enclosure using a crescent wrench or channel lock pliers.
13. Install the security seal wire into and through one of the two holes in the end cap. Choose holes that minimize counterclockwise rotation of the end cap when the security wire is taut (maximum wire diameter.078 inch; 2.0mm) (see Figure 3-34).
14. Apply conduit sealing compound according to manufacturer's recommendations.
15. Apply power to the meter.
16. This completes the Acquisition Module replacement procedure.

Appendix A: Conversion factors

A.1 Conversion factors per units of measurement

The following table includes conversion factors for many of the Metric and U.S. Customary units of measure used with Daniel 3812 Liquid Ultrasonic Flow Meters and Daniel MeterLink.

Table A-1 Conversion factors per units of measurement

Conversion factors	Unit of measurement
(°F-32)x(5/9)–>°C (°C+273.15)–>K	
1	K/°C
5/9	°C/°F
10^{-6}	MPa/Pa
0.006894757	MPa/psi
0.1	MPa/bar
0.101325	MPa/atm
0.000133322	MPa/mmHg
0.3048	m/ft
0.0254	m/in
10^{3}	dm^3/m^3
10^{-6}	m^3/cc (=m^3/cm^3)
$(0.3048)^3$	m^3/ft^3
$(0.0254)^3$	m^3/in^3
3600	s/h
86400	s/day
10^{3}	g/kg
0.45359237	kg/lbm
231	in^3/gal
42	gal/bbl (barrel)
0.0037854	gal/m^3
6.289811	bbl/m^3
10^{-3}	Pa • s/cPoise
1.488	Pa • s/(lb/(ft • s))

A.2 K Factor conversions

A.2.1 K-Factor and inverse K-Factor

Equation A-1 Frequency volumetric flow rate K-Factor

$$KFactor = \frac{FreqQ_{FullScale}}{(MaxFreq)3600s \S hr} \quad *$$

and

Equation A-2 Frequency volumetric flow rate inverse K-Factor

$$InvKFactor = \frac{(MaxFreq)(3600s \S hr)}{FreqQ_{FullScale}} \quad *$$

where

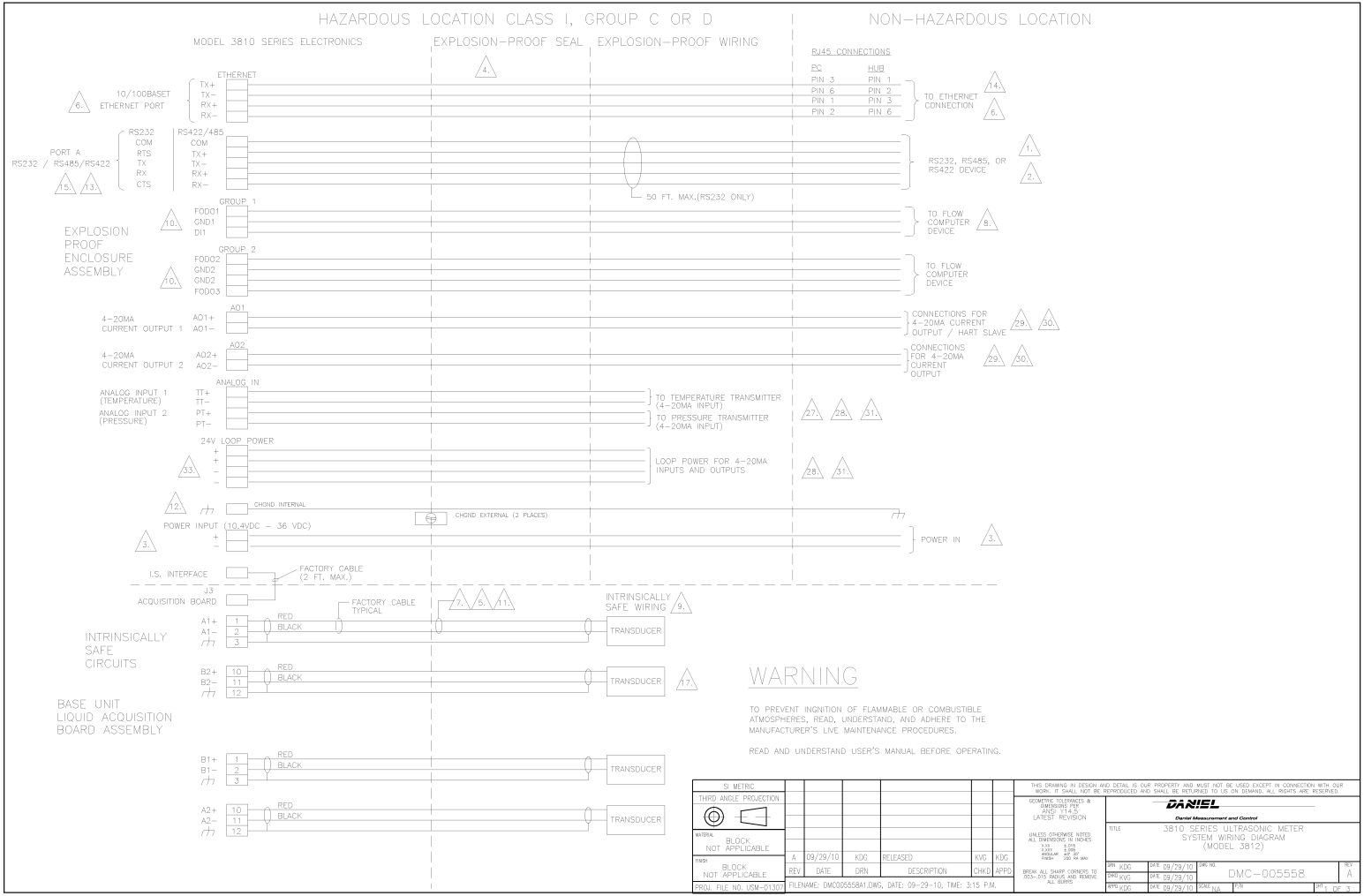
$KFactor$	=	frequency "K-Factor" (pulses/volume**) (**Freq1KFactor** and **Freq2KFactor**)
$InvKFactor$	=	frequency "Inverse K-Factor" (volume**/pulse) (**Freq1InvKFactor** and **Freq2InvKFactor**)
$FreqQ_{FullScale}$	=	frequency full-scale volumetric flow rate (volume**/time unit*) (**Freq1FullScaleVolFlowRate** and **Freq2FullScaleVolFlowRate**)
$MaxFreq$	=	maximum frequency (Hz = pulses/time unit*) (**Freq1MaxFrequency** and **Freq2MaxFrequency**)
* $TimeUnit$	=	time conversion factor depends on the VolFlowRate Time Unit data point: • volume/second = 1 s/s • volume/minute = 60 s/m • volume/hour = 3600 s/h • volume/day = 86400 s/d
** $Volume$	=	where the volume is selected via data points: • Units System • VolUnitUS(- gallons - barrels • VolUnitMetric - cubic meters - liters

Appendix B: Engineering drawings

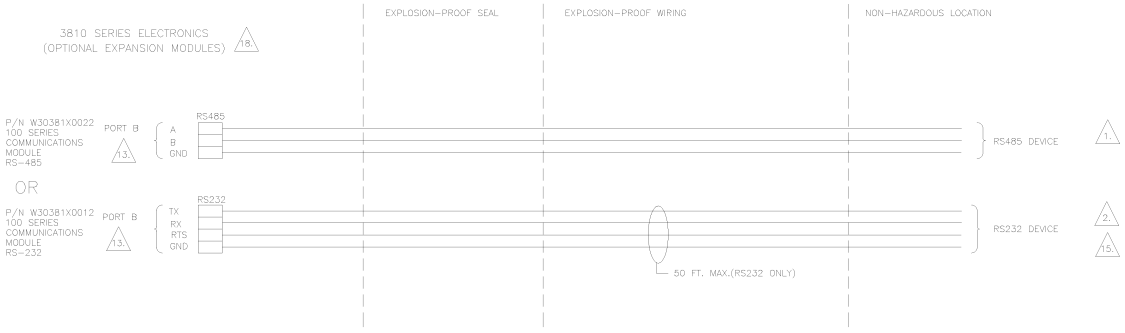
B.1 Daniel 3812 Liquid Ultrasonic Flow Meter drawings

This appendix contains the following engineering drawing(s) for the ultrasonic meter:

DMC-005558 Daniel 3812 Liquid Ultrasonic Flow Meter System Wiring Diagram


HAZARDOUS LOCATION CLASS I, GROUP C OR D
NON-HAZARDOUS LOCATION
MODEL 3810 SERIES ELECTRONICS
EXPLOSION-PROOF SEAL
EXPLOSION-PROOF WIRING
RJ45 CONNECTIONS
PC HUB
PIN 3 PIN 1
PIN 6 PIN 2
PIN 1 PIN 3
PIN 2 PIN 6
ETHERNET
10/100BASET ETHERNET PORT
TX+
TX-
RX+
RX-
TO ETHERNET CONNECTION
PORT A RS232 / RS485/RS422
RS232 COM RTS TX RX CTS
RS422/485 COM TX+ TX- RX+ RX-
50 FT. MAX.(RS232 ONLY)
RS232, RS485, OR RS422 DEVICE
EXPLOSION PROOF ENCLOSURE ASSEMBLY
GROUP 1
FOD01
GND1
DI1
TO FLOW COMPUTER DEVICE
GROUP 2
FOD02
GND2
GND2
FOD03
TO FLOW COMPUTER DEVICE
AO1
4-20MA CURRENT OUTPUT 1
AO1+
AO1-
CONNECTIONS FOR 4-20MA CURRENT OUTPUT / HART SLAVE
AO2
4-20MA CURRENT OUTPUT 2
AO2+
AO2-
CONNECTIONS FOR 4-20MA CURRENT OUTPUT
ANALOG IN
ANALOG INPUT 1 (TEMPERATURE)
ANALOG INPUT 2 (PRESSURE)
TT+
TT-
PT+
PT-
TO TEMPERATURE TRANSMITTER (4-20MA INPUT)
TO PRESSURE TRANSMITTER (4-20MA INPUT)
24V LOOP POWER
LOOP POWER FOR 4-20MA INPUTS AND OUTPUTS
CHGND INTERNAL
CHGND EXTERNAL (2 PLACES)
POWER INPUT (10.4VDC - 36 VDC)
POWER IN
I.S. INTERFACE
FACTORY CABLE (2 FT. MAX.)
J3
ACQUISITION BOARD
FACTORY CABLE TYPICAL
INTRINSICALLY SAFE WIRING
INTRINSICALLY SAFE CIRCUITS
A1+
A1-
B2+
B2-
RED
BLACK
TRANSDUCER
BASE UNIT LIQUID ACQUISITION BOARD ASSEMBLY
B1+
B1-
A2+
A2-
WARNING
TO PREVENT INGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, READ, UNDERSTAND, AND ADHERE TO THE MANUFACTURER'S LIVE MAINTENANCE PROCEDURES.
READ AND UNDERSTAND USER'S MANUAL BEFORE OPERATING.
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL BLOCK NOT APPLICABLE
FINISH BLOCK NOT APPLICABLE
PROJ. FILE NO. USM-01307
A 09/29/10 KDG RELEASED KVG KDG
REV DATE DRN DESCRIPTION CHKD APPD
FILENAME: DMC005558A1.DWG, DATE: 09-29-10, TIME: 3:15 P.M.
THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. IT SHALL NOT BE REPRODUCED AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS ARE RESERVED.
GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION
UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.010
X.XXX ±.005
ANGULAR ±.50°
FINISH 250 RA MAX
BREAK ALL SHARP CORNERS TO .005-.010 RADIUS AND REMOVE ALL BURRS
DANIEL
Daniel Measurement and Control
TITLE 3810 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM (MODEL 3812)
DRN KDG DATE 09/29/10
DWG NO. DMC-005558
REV A
APPD KVG DATE 09/29/10
APVD KDG DATE 09/29/10
SCALE NA
SIZE D
SHT 1 OF 2

HAZARDOUS LOCATION CLASS I, GROUP C OR D



SI METRIC						
THIRD ANGLE PROJECTION						
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FINISH: BLOCK NOT APPLICABLE	A	09/29/10	KDG	RELEASED	KVG	KDG
PROJ. FILE NO. USM-01307	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

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UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ± .010
X.XXX ± .005
ANGULAR ± .5°
FINISH 250 RA MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

DANIEL
Daniel Measurement and Control

TITLE: 3810 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM (MODEL 3812)

DRN: KDG	DATE: 09/29/10	DWG NO.	REV.
CHKD: KVG	DATE: 09/29/10	DMC-005558	A
APPD: KDG	DATE: 09/29/10	SCALE: NA	P/N

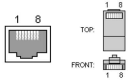
SHT 2 OF 3

NOTES:

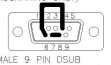
1. MAX LENGTH OF RS-485 WIRING IS 2,000 FT.
2. ETHERNET OR RS-422 IS THE PREFERRED COMMUNICATIONS INTERFACE. OPTIONALLY, RS-232 MAY BE USED FOR SHORT DISTANCES, (50 FT.)
3. POWER INPUT IS NOMINAL 24 VDC. INPUT RANGE 10.4-36V DC. POLARITY INSENSITIVE
4. AN EXPLOSION-PROOF SEAL IS REQUIRED WITHIN 457 MM(18 INCHES) OF THE ENCLOSURE.
5. TRANSDUCER CABLE IS 26 AWG. SHIELDED PAIR
6. FOR OPTIMUM DIAGNOSTIC INTERFACE, WIRING ETHERNET PORT IS RECOMMENDED. USE CAT5 ETHERNET CABLE
7. INTRINSICALLY SAFE WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE ARTICLE 504 OF THE NATIONAL ELECTRICAL CODE OR RULE 18-066 OF THE CANADIAN ELECTRICAL CODE.
8. DIGITAL INPUT 1 IS CONTACT CLOSURE ONLY.
9. TRANSDUCER PAIRS REQUIRED

MODEL NO.	TRANSDUCER PAIRS REQUIRED	TYPICAL CHORDS USED
3812	2	A,B

10. FODD OUTPUTS 1 THROUGH 3 CAN BE INDEPENDENTLY CONFIGURED TO FUNCTION AS FREQUENCY OUTPUTS OR DIGITAL STATUS OUTPUTS. THEY CAN EACH BE INDEPENDENTLY CONFIGURED TO DRIVE AS TTL OR OPEN COLLECTOR.
11. WHEN PROCESS FLUID TEMPERATURE EXCEEDS 60 °C (140 °F), ELECTRONICS MUST BE REMOVED FROM THE METER BODY (i.e. SPOOL PIECE ACTING AS PROCESS FLUID CONDUIT) AND MOUNTED NEXT TO THE METER BODY ON A PIPE STAND OR OTHER RIGID STRUCTURE.
12. THE INTERNAL GROUND LUG IS THE PRIMARY GROUNDING CONNECTION AND MUST BE INSTALLED TO COMPLY WITH SAFETY CERTIFICATIONS. THE EXTERNAL GROUND LUG IS A SECONDARY CONNECTION AND MAY BE USED AS WELL WHERE LOCAL CODES ALLOW.
13. COMM SIGNAL NAMING CONVENTION IS WITH RESPECT TO METER. (I.E. PC – TX –> METER – RX)
14. RJ45 SOCKET NUMBERING



15. PC SIDE SERIAL CONNECTION MUST BE WIRED FOR COMPLETE NULL MODEM FOR SUCCESSFULL HOOKUP TO METER
NULL MODEM CONNECTIONS FOR PC END OF CABLE (RS232 WITH NO HANDSHAKING ONLY)



FEMALE 9 PIN DSUB CONNECTOR (BACK VIEW)

CPU MODULE		DB9 (FEMALE)
RX	-->	PIN 3
TX	-->	PIN 2
COM	-->	PIN 5
		PIN 1
		PIN 4
		PIN 6
		PIN 7
		PIN 8

16. CPU MODULE DIP SWITCH SETTINGS

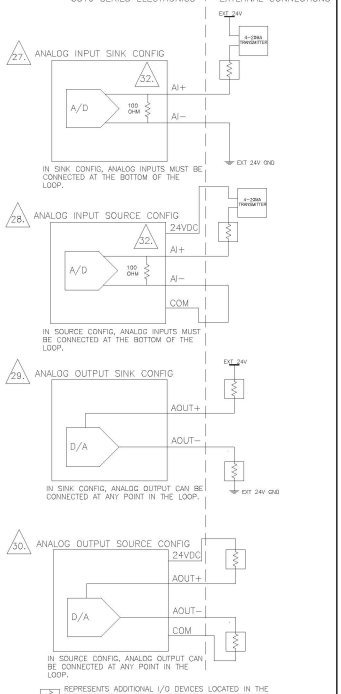
SWITCH	DESCRIPTION
PORT A	PORT A OVERRIDE
DHCP	DHCP SERVER ENABLE
WRITE PROT.	MEMORY PROTECT

TO ENABLE THE PORT A OVERRIDE, SWITCH MUST BE MOVED FROM THE OFF TO ON POSITION. PORT A WILL BE SET TO 19200,8,N,1 ID 32 FOR TWO MINUTES.

17. MODEL 3810 SERIES TRANSDUCERS TYPE LT-10
PROCESS TEMPERATURE MUST NOT EXCEED THE OPERATING TEMPERATURE RANGE OF THE TRANSDUCERS AS INIDCATED IN THE TABLE BELOW.

TRANSDUCER TYPE	PROCESS TEMPERATURE RANGE
LT-10	-50 °C (-58 °F) TO +100 °C (+212 °F)

18. THE 3810 SERIES METER HAS ONE AVAILABLE SLOT FOR AN EXPANSION MODULE.



31. ANALOG INPUT 1 AND ANALOG INPUT 2 ARE FUNCTIONALLY IDENTICAL AND ARE NOT ELECTRICALLY ISOLATED FROM EACH OTHER.
32. ANALOG INPUT 1 AND ANALOG INPUT 2 HAVE ADDITIONAL 150 OHMS LOOP IMPEDANCE FOR COMPLIANCE WITH HART COMMUNICATION REQUIREMENTS.
33. 24 VOLTS DC OUTPUT CAN BE USED TO SOURCE POWER TO ONE OR MORE OF THE ANALOG INPUTS OR OUTPUTS.

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BLOCK NOT APPLICABLE
FINISH: BLOCK NOT APPLICABLE
PROJ. FILE NO. USM-01307

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
A	09/29/10	KDG	RELEASED	KVG	KDG

FILENAME: DMC005558A3.DWG, DATE: 09-29-10, TIME: 3:15 P.M.

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GEOMETRIC TOLERANCES IN DIMENSIONING PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 125 RA MAX

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

DANIEL
Daniel Measurement and Control

TITLE: 3810 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM (MODEL 3812)

DRN KDG	DATE 09/29/10	DWG NO.	REV
CHKD KVG	DATE 09/29/10	DMC-005558	A
APPD KDG	DATE 09/29/10	SCALE NA	F/N SHT 3 OF 3

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Unable to Connect to Meter 24
Unable to connect to meter 24
Units of measurement 79

V

Validity 11

W

Waveform noise 17
Windows® XP with Security Update 30

DANIEL™ MEASUREMENT AND CONTROL, INC.
RETURNED MATERIAL AUTHORIZATION

REPAIR FORM FOR USED EQUIPMENT
INCLUDING DECONTAMINATION/CLEANING STATEMENT

A Return Material Authorization (RMA) number must be obtained prior to returning any equipment for any reason. Download the RMA form on the Daniel Measurement and Control, Inc. Support Services web page by selecting the link below.

http://www2.emersonprocess.com/EN-US/BRANDS/DANIEL/SUPPORT-SERVICES/Pages/Support-Services.aspx

1. Return Material Authorization (RMA) Number_____
2. Equipment to be returned:
   Model Number _____Serial Number_____
3. Reason for return:
   _____
   _____
   _____
   _____
   _____

Decontamination/Cleaning Fluids Process			
A. List each substance in which the equipment was exposed. Attach additional documents if necessary.			
Common Name	CAS# if Available	Used for Hazardous Waste (20 CFR 261)	EPA Waste Code if used for hazardous waste
		[ ] Yes [ ] No	
		[ ] Yes [ ] No	
		[ ] Yes [ ] No	
		[ ] Yes [ ] No	
		[ ] Yes [ ] No	
		[ ] Yes [ ] No	

B. Circle any hazards and/or process fluid types that apply:

Infectious	Radioactive	Explosive	Pryophoric	Poison Gas	
Cyanides	Sulfides	Corrosive	Oxidizer	Flammable	Poison
Carcinogen	Peroxide	Reactive-Air	Reactive-Water	Reactive-Other (list):	

Other Hazard Category (list):

C. Describe decontamination/cleaning process. Include MSDS description for substances used in decontamination and cleaning processes. Attach additional documents if necessary.

Shipping Requirements

Failure to comply with this procedure will result in the shipment being refused.

1. Write the RMA number on the shipping package.
2. Inside the package include one copy of this document and all required Material Safety Data Sheets (MSDS)
3. Outside of the package attach one copy of this document and all required Material Safety Data Sheets (MSDS).

THIS EQUIPMENT, BEING RETURNED "FOR REPAIR," HAS BEEN COMPLETELY DECONTAMINATED AND CLEANED. ALL FOREIGN SUBSTANCES HAVE BEEN DOCUMENTED ABOVE AND MSDS SHEETS ARE ATTACHED.

By_____ _____
(Signature) (Print name)

Title:_____ Date:_____

Company:_____

Phone: _____ Fax:_____

Daniel Gas and Liquid Ultrasonic Flow Meters power PlantWeb by communicating health and process variable information via the HART® protocol and are core components of the PlantWeb digital plant architecture.

Emerson Process Management

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